# EXHIBIT 3
# [FILED UNDER SEAL]

UNITED STATES DISTRICT COURT

EASTERN DISTRICT OF TEXAS

SHERMAN DIVISION

| | |
|---|---|
| The State of Texas, et. al.<br>Plaintiff,<br><br><br>v.<br><br><br><br>Google LLC, Defendant. | Case No: 4:20-cv-00957-SDJ |

Rebuttal Report of Matthew Weinberg

Dated: September 9, 2024

_____

Matthew Weinberg

1

HIGHLY CONFIDENTIAL

<div align="right">HIGHLY CONFIDENTIAL</div>

## I.    INTRODUCTION

### A.    Assignment

1.    I have been retained by counsel for the State of Texas to provide expert analysis and opinions on behalf of all the Plaintiff States in this case. As part of my assignment in this case, on June 7, 2024, I submitted an opening expert report ("Weinberg Opening Report"), which is incorporated herein.

2.    Google's retained experts submitted reports on July 30, 2024, and August 6, 2024. As discussed below, some of Google's experts' reports[1] address my Opening Report, as well as discuss issues on which I have expertise to evaluate and opine. As part of the Plaintiff States' opportunity to submit rebuttal expert opinions and reports, I have been asked to evaluate all Google's experts' reports that relate to my opinions and expertise. As in my Opening Report, in my Rebuttal Report ("Weinberg Rebuttal Report"), I am not expressing any legal opinions. My opinions are again based on my specialized knowledge in Algorithmic Mechanism Design and Auction Theory ("Auction Theory"),[2] review of facts and data, and application of established economic principles and methods to the facts of this case.

3.    I have not evaluated every opinion offered by every expert; claims that are not addressed directly do not imply that I concur with those opinions. My compensation also remains unchanged. My consulting rate for this matter is $500 per hour. My compensation does not depend on the outcome of this case.

### B.    Qualifications

4.    I am an associate professor of computer science at Princeton University, where I have taught since 2017. I am also the associate director of Princeton University's Center on the Decentralization of Power (DeCenter) and affiliated with Princeton's Center for Information and Technology Policy (CITP), Program in Applied and Computational Mathematics (PACM),

---

[1] Throughout this report, I refer to "Google's experts' reports." Unless otherwise noted, this term refers to the expert reports submitted by Professor Milgrom ("Milgrom Report"), Professor Baye ("Baye Report"), and Professor Wiggins ("Wiggins Report").

[2] Auction Theory processes to transfer items from sellers to buyers, often with payments from buyers to seller, and the outcomes of these processes. *See* Krishna, Vijay. *Auction theory*. Academic press, 2009; Nisan N, Roughgarden T, Tardos E, Vazirani VV, eds. *Algorithmic Game Theory*. Cambridge University Press; 2007. In my Opening Report, I discuss relevant concepts in Auction Theory. *See* Weinberg Opening Report ¶¶15 – 60.

HIGHLY CONFIDENTIAL

and Bendheim Center for Finance. I received my B.A. in Mathematics from Cornell University in 2010, and my Ph.D. in Electrical Engineering and Computer Science from the Massachusetts Institute of Technology in 2014.

5.    My field of expertise includes Auction Theory[3] (defined in Footnote 2) and Algorithmic Mechanism Design, the study of algorithms (such as ad auctions) that involve economic incentives (such as those of publishers, exchanges, ad buying tools, and advertisers). I have published over 50 papers across venues within both computer science and economics. My works have received the top dissertation award and the best full paper award from ACM SIGecom, the interdisciplinary research community studying Economics and Computation, and a test of time award from IEEE Foundations of Computer Science, the research community studying Theoretical Computer Science. For my research and teaching, I have also received a Sloan Foundation Fellowship, an NSF CAREER Award, Princeton's President's Award for Distinguished Teaching, a Phi Beta Kappa Teaching Award, and an Engineering Council Lifetime Achievement Award.

6.    My CV, which also contains a list of my publications in the past ten years, is attached in Appendix A. I have not testified in the last ten (10) years.

## C.    Case Background

7.    As stated in my Original Report, a coalition of 16 states (Texas, Alaska, Arkansas, Florida, Idaho, Indiana, Kentucky, Louisiana, Mississippi, Missouri, Montana, Nevada, North Dakota, South Carolina, South Dakota, and Utah) and the Territory of Puerto Rico ("Plaintiff States"), led by the State of Texas, filed a lawsuit against Google LLC ("Google"), claiming Google violated federal and state antitrust laws and other state laws, in Google's Deceptive Conduct in the online display advertising market.

---

[3] My publications have included articles relating to auctions and Auction Theory. *See, e.g.,* Jose Correa, Andres Cristi, Andres Fielbaum, Tristan Pollner, S. Matthew Weinberg: [CCFPW 22] Optimal Item Pricing in Online Combinatorial Auctions. In the 23rd Annual Conference on Integer Programming and Combinatorial Optimization (IPCO), 2022; Meryem Essaidi, Matheus V. X. Ferreira, S. Matthew Weinberg: [EFW 22] Credible, Strategyproof, Optimal, and Bounded Expected-Round Single-Item Auctions for All Distributions. In the 13th Annual Innovations of Theoretical Computer Science (ITCS), 2022; Matheus V. X. Ferreira, S. Matthew Weinberg: [FW 20] Credible, Truthful, and Two-Round (Optimal) Auctions via Cryp- tographic Commitments. In the 21st Annual ACM Conference on Economics and Computation (EC), 2020; Christos-Alexandros Psomas, Ariel Schvartzman, S. Matthew Weinberg: [PSW 19] Smoothed Analysis of Multi-Item Auctions with Correlated Values. In the 20th Annual ACM Conference on Economics and Computation (EC), 2019; Mark Braverman, Jieming Mao, S. Matthew Weinberg: [BMW 18] On Simultaneous Two-Player Combinatorial Auctions, In the 29th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA) 2018.

8.   I also understand that the Plaintiff States have the opportunity to submit rebuttal expert testimony and reports and that I may be asked to evaluate the reports and opinions offered by Google's experts in connection with those rebuttal reports.

9.   I have reviewed, signed, and complied with the Confidentiality Order entered in this case, most recently the updated Protective Order signed on January 22, 2024. My supporting team has also read, signed, and complied with the Confidentiality Order entered in this case. I have also reviewed the Stipulation and Order regarding Expert Discovery in this case.

10.   A list of all materials relied upon and considered in this Rebuttal Report and my Opening Report, including documents and transcripts, is attached as Appendix C.

11.   I understand that document productions are ongoing in this case and that additional relevant documents may be produced in this case by Google and third parties right before, and after, I issue this report. I also understand that, after I submit this Rebuttal Report, expert and fact witnesses for Google, the U.S. Department of Justice, and other plaintiffs will be testifying at trial in the parallel case pending in the Eastern District of Virginia (*United States et al. v. Google LLC*, No. 1:23-00108). I may, and reserve the right to, review and rely on additional documents, including transcripts and testimony, in conducting my work and forming my opinions in this case.

12.   I reserve the right to supplement or amend this report if my opinions change or require supplementation as a result of my ongoing review of documents. I reserve the right to use graphics, figures, and/or illustrations at trial to depict the conclusions drawn in my Opening Report and my Rebuttal Report.

### D.   Methodology[4]

13.   Throughout this Rebuttal Report, I apply the mathematical principles, results, and insights that stem from first principles of Auction Theory and game theory literatures. These methods of auction analysis are commonly accepted by researchers and practitioners across fields, such as, economics, computer science, and mathematics.

---

[4] I hereby incorporate all methodology within my Opening Report. *See* Weinberg Opening Report ¶¶13 and 14.

14.    These tools are commonly accepted by researchers and practitioners for the analysis of auctions for online display advertisements (or ads).

15.    In my Opening Report, I overview Auction Theory principles necessary to my analysis.

16.    In this report, I apply Auction Theory principles to issues raised by Google's Experts' Reports and express certain opinions with respect thereto.

### E.    Summary of Rebuttal Opinions

17.    Contrary to the opinions of Google's experts,[5] Google's entire Display Advertising Real Time Bidding Ecosystem ("Google's Display Advertising RTB Ecosystem") deceives auction participants.[6] I apply first principles of Auction Theory to explain how a generally deceptive Display Advertising RTB Ecosystem, such as Google's Display Advertising RTB Ecosystem, can influence behavior in any auction. I repeat and expound on this opinion in Section IV.

18.    Google's experts' analysis[7] of auction participants' behavior is incorrect. I explain why that analysis is incorrect in Section V.[8] I addressed and analyzed participants' behavior in my Opening Report, and I reconfirm that analysis here.

19.    Contrary to the opinions of Google's experts,[9] Project Bernanke did not benefit Google Display Network ("GDN") advertisers during periods when it used a first price payment rule. Project Bernanke also decreased win rates for advertisers using non-GDN tools. Further, according to first principles of Auction Theory, GDN advertisers would have "shaded their bids"[10] if they

---

[5] *See* Milgrom Report ¶16 ("false conclusions that Google's auction programs were anticompetitive and/or deceptive"); Wiggins Report ¶19, ¶45 ("advertisers need not, as a general matter, know all of the details"), ¶83 ("publishers need not attempt to master every aspect of the auctions"); Baye Report ¶596 ("customers are provided with all of the relevant price information they need from Google").

[6] I define "Deceptive Conducts" and "Google's Display Advertising RTB Ecosystem" in the below II. Definitions.

[7] *See* Milgrom Report, ¶25 and ¶28; see also Wiggins Report ¶19,

[8] I define default v. sophisticated in Section II.

[9] *See* Milgrom Report ¶28 ("[publisher] floor price adjustments require no more sophistication than is routine in economic decision-making"), ¶29 ("advertisers and the intermediaries that represent them need no unusual sophistication"); Milgrom Report, Section IV.D.6; Wiggins Report ¶19 ("advertisers, publishers, and their intermediaries make decisions primarily by monitoring return metrics, performing tests, and learning and adapting"), ¶228; Baye Report ¶596 ("customers are provided with all of the relevant price information they need").

[10] I elaborate in Section VII on what it means for a GDN advertiser to 'shade their bid' when using GDN's "autobidding" tool.

knew about Project Bernanke.[11] I explain why Google's experts' opinions about Project Bernanke are incorrect in Section VII.

20.    Contrary to the opinions of Google's experts,[12] Dynamic Allocation ("DA") preferred AdX over non-Google exchanges, leading to an increase in win rate and revenue for AdX, and lower win rates and revenues for non-Google exchanges, as further discussed in Section VIII.[13]

21.    Contrary to the opinions of Google's experts,[14] Enhanced Dynamic Allocation ("EDA") further preferred AdX over other exchanges by extending this preferential treatment to impressions formerly reserved for direct deals, and reduces the value of direct deals to advertisers. I explain why Google's experts' opinions about EDA are incorrect in Section IX.

22.    Contrary to the opinions of Google's experts,[15] Last Look ("Last Look") preferred AdX over non-Google exchanges. I discussed this further in Section X.

23.    Contrary to the opinions of Google's experts,[16] Google concealed material information from advertisers by concealing the Reserve Price Optimization ("RPO") conduct. In Section XI, I apply first principles of Auction Theory to explain how advertisers would have shaded their bids if they knew the true mechanics underlying RPO, how Google's RPO exemption policy preferences GDN, and how Google did not communicate the true mechanics to non-Google tools.

24.    Contrary to the opinions of Google's experts,[17] Google concealed key information from advertisers and publishers regarding Dynamic Revenue Share ("DRS"). Applying first principles of Auction Theory, advertisers would have changed their bids if they knew the true mechanics underlying DRSv1 and DRSv2. It is my opinion that DRSv2 decreased advertisers' payoff. In Section XII, I further expound on my opinions, including: Google's communication regarding DRSv2 and tDRS was misleading; Google's DRS exemption policy preferenced

---

[11] During periods when Project Bernanke used a first-price payment rule.

[12] *See* Milgrom Report ¶¶158–176; Wiggins Report ¶¶157–160; Baye Report ¶¶103–107.

[13] During periods when Project Bernanke used a first-price payment rule.

[14] *See* Milgrom Report ¶¶158–176; Wiggins Report ¶¶157–160; Baye Report ¶¶103–107.

[15] Milgrom Report ¶¶354, 363–377; Baye Report ¶547.

[16]  Milgrom Report ¶¶406–414; Wiggins Report ¶¶145–147, 186–209.

[17] Milgrom Report ¶¶467–469; Wiggins Report ¶¶215–223

Google ad buying tools; and the DRS exemption policy was not communicated to non-Google tools.

25. Contrary to the opinions of Google's experts,[18] applying first principles of Auction Theory, Exchange Bidding's auction mechanics generate less revenue for publishers than Header Bidding. Exchange Bidding ("Exchange Bidding") exchanges still have a Last Look advantage over Header Bidders ("Header Bidders"). I explain why Google's experts' opinions are incorrect within Section XIII. [19]

26. Contrary to the opinions of Google's experts,[20] applying first principles of Auction Theory, Unified Pricing Rules ("UPR") would decrease publishers' revenue, and could lead to a higher win rate and revenue for AdX. Further, UPR would not meaningfully address self-competition. I explain why Google's experts' opinions about UPR are incorrect in Section XIV.

27. The opinions expressed above and herein – including those relating to auction transparency, deception, and mechanics, and the behavior of auction participants – are based upon my training and experience in Auction Theory and design as well as my understanding of the applicable facts.

---

[18] *See* Milgrom Report, Section XIII.

[19] *See* Section XIII of this report.

[20] *See* Milgrom Report ¶¶20.d, 519–561; Baye Report ¶¶89–90, 500–517.

## II.    DEFINITIONS

28.    "Google's Display Advertising RTB Ecosystem" as used herein refers to Google's display advertising auctions and platforms,[21] including all the associated Deceptive Conducts and actions, and inclusive of the auction participants, *i.e.*, advertisers, their agencies, and publishers.

29.    "Display Advertising RTB Ecosystem" as used herein refers to display advertising auctions and platforms generally, including all the associated conducts and actions, and inclusive of the auction participants, *i.e.*, advertisers, their agencies, and publishers.

30.    "Transparent" as used herein refers to the dictionary definition of "transparent" as "free from pretense or deceit; easily detected or seen through; readily understood; characterized by visibility or accessibility of information."[22]

31.    "Transparent Disclosure" as used herein refers to disclosures that are likely to or reasonably believed would contribute to, assist, or allow a participant to behave more optimally because the disclosure reveals information that is truthful, equally accessible and informative.

32.    "Transparent Action" as used herein refers to the actions of ad tech intermediaries that assist participants in behaving optimally and do not encourage participants to behave sub-optimally.

33.    "Transparent Auction" as used herein refers to auctions in Display Advertising RTB Ecosystem with Transparent Disclosures.

34.    "Deceptive Conduct"[23] as used herein refers to the conduct of ad tech intermediaries[24] is conduct consisting of the misrepresentation of material information, the incomplete or untimely disclosure of material information, and/or the concealment or non-disclosure of material information, where such acts and omissions are undertaken with the intent or knowledge that they will likely cause auction participants in the Display Advertising RTB

---

[21] Including, adtech intermediaries like ad servers, ad exchanges, and ad buying tools for large and small advertisers.

[22] "Transparent." Merriam-Webster.com Dictionary, Merriam-Webster, https://www.merriam-webster.com/dictionary/transparent. Accessed on September 8, 2024.

[23] In my Opening Report, I used several terms to describe and refer to Google's Deceptive Conduct. *See* Weinberg Opening Report ¶¶11-12, 183, 187, 255, 258; see also Expert Report of Jeffrey Andrien, June 7, 2024 ("Andrien Report"), ¶98, n. 267. For the sake of clarity and simplicity, because all of those examples fall within my definition of deceptive, in this report I refer to that conduct using the term deceptive.

[24] Ad tech intermediaries include, but are not limited to, ad servers, ad exchanges, and ad buying tools for large and small advertisers.

Ecosystem to engage in sub-optimal behavior or engage in behavior in which they would not have otherwise engaged.

35. "Default"[25] as used herein refers to the default, i.e., initial, state of an auction participant in the Display Advertising RTB Ecosystem. Furthermore, the Default participant is presumed herein to rely upon the representations and public disclosures in the Display Advertising RTB Ecosystem in which they are participating.[26]

36. "Sophisticated" as used herein refers to an auction participant in the Display Advertising RTB Ecosystem who sets, implements, and pursues strategies based upon independent analysis of all data available to that participant, and no limited to only data available to them within the tools of Display Advertising RTB Ecosystem.

37. "Sophisticated and Fully Informed"[27,28] as used herein refers to an auction participant in the Display Advertising RTB Ecosystem who sets, implements, and pursues strategies based upon all true properties of the Display Advertising RTB Ecosystem, even if those true properties are inconsistent with representations, public disclosures, and available data.

38. "Ad Server" as used herein refers to the tool within the Display Advertising RTB Ecosystem that communicates information about a publisher's impression available for bid (such as

---

[25] Applying this definition of "Default," I refer herein to "Default Participants," "Default Advertisers," "Default Ad Agencies," "Default Publishers," and "Default Intermediaries" (intermediaries including, as defined above, Ad Servers, Ad Exchanges, and Ad Buying Tools) as, respectively, those participants, advertisers, ad agencies. publishers, and intermediaries in their initial state within the Display Advertising RTB Ecosystem who are presumed to rely and act upon the representations and public disclosures in the Display Advertising RTB Ecosystem in which they are participating. *See, e.g.,* Expert Report of M. Weinberg, n. 114 (for the purpose of this report, I consider the term "default" to have the same meaning and application as the term "typical" in the Weinberg Opening Report). I also refer herein to "Default Behavior" as the strategies, decisions, and acts of such Default participants and entities within the Display Advertising RTB Ecosystem.

[26] In my Opening Report, I used the term "typical" to denote these types of participants. Herein, I have switched to using the term "default" to avoid any confusion as to what proportion of participants would fall into this category versus the "Sophisticated" category as defined immediately hereafter.

[27] Applying this definition of "Sophisticated and Fully Informed," I refer herein to "Sophisticated and Fully Informed Participants," "Sophisticated and Fully Informed Advertisers," "Sophisticated and Fully Informed Ad Agencies," "Sophisticated and Fully Informed Publishers," and "Sophisticated and Fully Informed Intermediaries" (intermediaries including, as defined above, Ad Servers, Ad Exchanges, and Ad Buying Tools) as, respectively, those participants, advertisers, ad agencies. publishers, and intermediaries in the Display Advertising RTB Ecosystem who set, implement, and pursues strategies based upon all true properties of the Display Advertising RTB Ecosystem, even if those true properties are inconsistent with representations, public disclosures, and available data. I also refer herein to "Sophisticated and Fully Informed Behavior" as the strategies, decisions, and acts of such Sophisticated and Fully Informed participants and entities within the Display Advertising RTB Ecosystem.

[28] "Sophisticated and Well Informed" as used herein refers to an auction participant in the Display Advertising RTB Ecosystem who sets, implements, and pursues strategies based upon material properties of the Display Advertising RTB Ecosystem beyond what is transparently disclosed, even if those material properties are inconsistent with representations, public disclosures, and available data. The distinction to "sophisticated and fully informed" is that the material properties may not include *all* material properties.

information regarding dimensions, placement, and user), acts as a centralized platform for ad management, determines which ads are best suited to show on a publisher's website, and enables publishers to track, manage, and sell their inventory in an automated fashion and maximize their yield, as discussed more fully in Section III.A.(1) of my Opening Report.

39. "Ad Buying Tool" as used herein refers to the tool within the Display Advertising RTB Ecosystem that enables the purchase of ad inventory based on the advertiser's or ad agency's ad campaign budget and goals, and connects to ad exchanges and to sellers, as discussed more fully in Section III.A.(2) of my Opening Report.

40. "Ad Exchange" as used herein refers to the software product within the Display Advertising RTB Ecosystem that enables the programmatic trading of impressions through auctions by connecting ad buyers and ad sellers, as discussed more fully in Section III.A.(3) of my Opening Report.

41. "Google Ad Server" as used herein refers to Google's Ad Server tool in the Display Advertising RTB Ecosystem, including Google's DoubleClick for Publishers ("DFP"), which is now part of Google Ad Manager ("GAM").

42. "Google Ad Buying Tools" as used herein refers to Google's Ad Buying Tools in the Display Advertising RTB Ecosystem, including DV360 and Google Ads.

43. "Google Ad Exchange" as used herein refers to Google's Ad Exchange product in the Display Advertising RTB Ecosystem, including Google's AdX, which is now part of Google Ad Manager (GAM).

44. "Weinberg Framework" as used herein refers to the approach of determining the impact of Google's Deceptive Conduct in the Display Advertising RTB Ecosystem by examining the impact of such conduct upon Default Participants and Sophisticated Participants (*i.e.,* collectively, all participants).

45. "Milgrom Framework" as defined herein refers to the approach of determining the impact of Google's Deceptive Conduct in the Display Advertising RTB Ecosystem by examining only the impact of such conduct upon Sophisticated and Fully Informed Participants.

### III.    FRAMEWORKS

46.    In order to evaluate aspects of Google's Display Advertising RTB Ecosystem that are deceptive, and to rebut the Wiggins's Report's opinions, I analyze the following frameworks from the Wiggins Report.

#### A.    The Wiggins Report Framework Analysis

47.    I start from the position that in Google's Display Advertising RTB Ecosystem, [29] each participant has an optimal set of strategies to achieve their objectives ("Optimal Behavior"). [30, 31]

48.    The Wiggins Report sets forth a framework ("Deceptive Conduct Marginal Benefits Framework" or "DCMB Framework") to evaluate whether Google's Deceptive Conduct impacted participants' Optimal Behavior. [32]

49.    The DCMB Framework consists of three elements: (1) evaluating whether each act is deceptive ("Element One"), (2) proposing an explicit change in behavior that may have occurred "but for" that deceptive act ("Element Two"), and (3) computing the marginal change in Google's profits in the "but for" world without that deceptive act ("Element Three").

50.    As set forth in the Wiggins Report, the DCMB Framework proposes to only count marginal changes that can be directly linked to a particular Google Deceptive Conduct, *i.e.*, to only count changes that are from the direct impact of a particular Deceptive Conduct.

51.    For Element One of the DCMB Framework, the Wiggins Report makes the assumption Google engaged in the Deceptive Conduct.

---

[29] I define Google's Display Advertising RTB Ecosystem in Section II., Definitions.

[30] Note that the optimal strategy may change depending on behavior of other participants and that it is not solely determined by the auction itself.

[31] For example, in a second-price auction (with or without reserve), an advertiser optimizes their payoff by bidding their true value. When a publisher sells an impression to a pool of buyers and believes each buyer's valuation to be equally likely to be any number between 0 and 1 and determined independently of the others, the publisher optimizes their expected revenue by running a second-price auction with reserve 1/2.

[32] *See* Expert Report of S. Wiggins, Section VII.

52.    For Element Two of the DCMB Framework, the Wiggins Report proposes the "but-for" behaviors justified by the Weinberg Opening Report and identifies four manners a transaction could be "affected" in light of those "but-for" behaviors: "(i) the clearing price, (ii) the winning bidder, (iii) whether the transaction cleared on AdX, or (iv) AdX's revenue share."[33]

53.    But even though the Wiggins Report  assumes that Google engaged in Deceptive Conduct under Element One, it proposes that participants would not have acted differently in the "but-for" worlds,  so there would be no "but-for" impact to any auction, , and no marginal changes to evaluate.[34]

54.    For Element Three of the DCMB Framework, the Wiggins Report attempts to quantify the impact of the proposed "but for" behavior ("Wiggins Report Proposition").  It does that by proposing that even if the participants had engaged in different behavior in the "but-for" worlds, there would still be no impact and thus no benefit to Google.

55.    The Wiggins Report Proposition has several errors.[35]  I identify those errors below.

56.    Using the Wiggins Report Proposition, the Wiggins Report then attempts to rebut the Andrien Report's claim ("Deceptive Conduct Total Impact Framework" or "DCTI Framework") — which relies on my Opening Report — that (A) every auction is affected by Google's Deceptive Conduct, ("Element A") and that (B) the impact of that deception affects all revenue from Google's display ad auctions ("Element B").[36]

**B.    Rebutting Wiggins Report Proposition And Supporting DCTI Framework**

57.    While it was outside the scope of my assignment to calculate damages for Google's Deceptive Conducts, my opinions below support the DCTI Framework and rebut the Wiggins Report

---

[33] *See* Expert Report of S. Wiggins, ¶142 ("In this section, I estimate how many transactions should have been excluded from Mr. Andrien's transaction counts because, under the plaintiffs' theory, the alleged deception could not have affected (i) the clearing price, (ii) the winning bidder, (iii) whether the transaction cleared on AdX, or (iv) AdX's revenue share.")

[34] Expert Report of S. Wiggins, ¶19 ("My analysis is grounded in the extensive evidence presented in Section II regarding ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ I conclude that none of the alleged deception in this case generated incremental profits for Google, and thus that the appropriate DTPA civil penalty based on Mr. Andrien's framework is zero.")

[35] To clarify, my primary opinion is that Google's Display Advertising RTB Ecosystem is deceptive. Still, I additionally correct the Wiggins Report's execution of the DCMB Framework.

[36] *See* Expert Report of S. Wiggins, ¶15; Expert Report of S. Wiggins, footnote 5.

Proposition. I provide the following opinions rebutting the Wiggins Report Proposition and supporting the DCTI Framework.[37]

58.    First, there is conduct-by-conduct evidence of Google's Deceptive Conducts with regard to Project Bernanke, DRS, and RPO. Google engaged in a pattern of pervasive and systemic deception. The objectives and mechanics of Google's Deceptive Conducts are similar across all three conducts.[38] In all three, the Deceptive Conduct was sustained across many years.[39]

59.    This evidence of pervasive and systemic Deceptive Conduct justifies Element A of the DCTI Framework *i.e.*, my opinion that the entire Google's Display Advertising RTB Ecosystem is deceptive.

60.    Google's particular Deceptive Conducts are evidence of Element One of the DCMB Framework. These establish that Google indeed took deceptive actions with regard to Project Bernanke, DRS, and RPO,[40] and therefore the remaining elements of the DCMB Framework are relevant.[41]

61.    There is additional evidence of Google's Deceptive Conducts which relate to aspects of Google's Display Advertising RTB Ecosystem beyond Project Bernanke, DRS, and RPO.[42] This evidence further supports Element A of the DCTI Framework.

_____

[37] Neither the DCTI Framework nor the Wiggins Report Framework require detailed implementation – the only interesting discussion is whether to take either of these views in the first place.

[38] For example, the following deceptive mechanisms appear across multiple Deceptive Conducts: false/misleading communications, proactive actions to conceal Deceptive Conduct in response to detection, the launch of products whose success *requires* deception, the concept of debt, random perturbations, and probabilistic throttling. The following objective is consistent across all Deceptive Conducts: deceive advertisers into bidding their true value for each impression, even though it is suboptimal, and charge them (at least) that value as often as possible (DRSv1/Bernanke do so in the dynamic region, DRSv2 charges *more* than that value in the dynamic region, RPO charges that value across any period of time where values in past auctions are representative of values for future auctions.)

[39] Project Bernanke and Global Bernanke was in operation from 2013 (see GOOG-DOJ-28385887 at -93, 94) to 2019 (see GOOG-AT-MDL-008842383 at -88). DRS and its variants were in operation from 2015 (GOOG-TEX-00777528 at -30) to 2019 (see GOOG-TEX-00858434). RPO was in operation from 2015 (GOOG-NE-06151351 at -52) to 2019 (see GOOG-AT-MDL-000987708 at -08).

[40] Project Bernanke, DRS, and RPO are explained in detailed below in Sections VII , XII, XI.

[41] If one wishes to take the DCMB Framework. As I previously noted, my Rebuttal Report will primarily justify the DCTI Framework.

[42] *See*, e.g., Section XIV UPR, Section VIII DA , Section IX EDA, Section Exchange Bidding XIII.

62.  Next, Google asserted that its Display Advertising RTB Ecosystem was simple, when it was anything but. For example, Google claimed to run a truthful second-price auction until 2019,[43] and due to Project Bernanke, DRSv1, DRSv2, and RPO, it was not optimal for advertisers to truthfully bid their values from 2013 to 2019.[44] This further supports Element A of the DCTI Framework, as it indicates even the decision to join Google's Display Advertising RTB Ecosystem in the first place is touched by Google's Deceptive Conducts.

63.  Finally, applying first principles of Auction Theory, Google's Display Advertising RTB Ecosystem influences auctions beyond what can be directly attributed to a particular Deceptive Conduct. This supports Element B of the DCTI Framework. There are two important related points:

   i.  First, as the Milgrom Report notes, according to first principles of Auction Theory, participants join Display Advertising RTB Ecosystems[45] due to the allure of simplicity:

   > Google recognized the advantages of bidder-truthful auctions, explaining them as follows: "It's faster, less costly, and more fair to the less sophisticated advertisers to structure the auction in favor of true value." *The lower transaction costs associated with bidding in a bidder-truthful auction encourage advertisers to participate on Google's platform,* which increases thickness, tending to improve the efficiency of its allocations and increase the prices paid to publishers. (*emphasis added*)[46] [47]

_____

[43] GOOG-DOJ-29803801 at -04. ("The AdX Auction model is 2nd price, as described in the Help Center. AdX runs a second price auction where the winner is the highest bid and the price is larger of the 2nd bid and the floor price. In other words, the transaction price equals the price to beat to win the auction. This price is independent of the winner's bids.".)

[44] Earliest of the listed Deceptive Conducts, Project Bernanke, started in 2013. *See* GOOG-AT-MDL-009644018, at cells C1, C2 ("Launch Date [...] 2013-11-11")

[45] Both the Milgrom Report (*see, e.g.*, ¶¶ 122, 202) and the Wiggins Report (*see* ¶ 239) refer to the relevant Display Advertising RTB Ecosystem.

[46] Expert Report of P. Milgrom, ¶65.

[47] Expert Report of P. Milgrom, ¶43.a ("In my own auction consulting in this industry and others, I have emphasized the importance of making bidding easier to encourage participation and promote value creation."); Expert Report of P. Milgrom, footnote 53 ("For example, in my published advice as consultant to the US Federal Communications Commission, I wrote that 'the auction process needs to be simple and easy enough to encourage and facilitate the participation of a wide array of broadcasters […] [and] make it very easy for broadcasters to make optimal bids.'"); Expert Report of P. Milgrom, ¶63 ("Bidder-truthful auctions reduce bidding errors and the costs of bidding because they eliminate any need for an advertiser to assess who else might be bidding, how much they might bid, or the publisher's floor price. In non-bidder-truthful auctions,

    **ii.** Therefore, applying first principles of Auction Theory, even if a particular Deceptive Conduct did not influence a participant's behavior, participants may have joined the Display Advertising RTB Ecosystem in the first place due solely to Google's Deceptive Conducts regarding its simplicity.

    **iii.** Second, Google's Deceptive Conducts can influence participants to act chaotically. Applying principles of Auction Theory, participants in a deceptive Display Advertising RTB Ecosystem could act chaotically by raising their bids in all auctions in response to RPO[48] ███████████████████████ ████████████,[49] regardless of whether those conducts are employed in each such auction. It may be difficult to connect such behavior to a particular Deceptive Conduct of Google.[50] However, applying principles of Auction Theory, such behavior arises when participants encounter substantial, numerous, or continual false and/or misleading communications and cleverly concealed deception.[51] This behavior could arise in any auction, including those not connected to the Deceptive Conducts.

---

each advertiser's bid depends on all of these factors. I have previously advised auctioneers to adopt bidder-truthful auctions, highlighting the importance of easy bidding.")

[48] The Milgrom Report cites evidence of such behavior. *See* Expert Report of P. Milgrom, at ¶32.b ("For example, an internal Google document found that certain buyers adjusted their bids in response to RPO, with the author noting, '[f]or RPO, some buyers are changing their bids […] *some bid higher*, some bid lower.'") (*emphasis added*)

[49] ██████████████████████████████████████████████████████████████████ ████████████████████████████████████

[50] This is in comparison to the behavior "bidding in the dynamic region during DRSv2" which I can connect to Google's concealment of and misleading communication surrounding DRSv2.

[51] GOOG-DOJ-15588979 at -80 ("Cross-publisher effect: once a buyer experiences the 'first-price' effect, they might assume it is occurring across the board, and then react to that not just on the optimized slot but on all slots. This could have the effect of driving down bids across the whole exchange.") This demonstrates a concern that bids will go down even on auctions not impacted by RPO.

IV.    **APPLYING FIRST PRINCIPLES OF AUCTION THEORY, OPINIONS OF GOOGLE'S EXPERTS THAT GOOGLE'S DISPLAY ADVERTISING RTB ECOSYSTEM IS TRANSPARENT AND NOT DECEPTIVE ARE INCORRECT.**

64.    I have been asked to review The Wiggins Report, which concerns the degree of Google's deception and the impact of that Deceptive Conduct. While I do not have an opinion on an appropriate damage calculation for Google's Deceptive Conduct, I offer my opinion on (a) elements of Google's Display Advertising RTB Ecosystem that are deceptive, and (b) manners in which that deception can impact outcomes.

A.    **Relevant Auction Theory**

65.    I describe in my Opening Report relevant concepts and principles of Auction Theory, that are incorporated herein. *See* my Opening Report Para. 15-60. I use and apply those concepts and principles in analyzing the Wiggins Report.

B.    **Google's Deceptive Conducts impact the entirety of Google's Display Advertising RTB Ecosystem.**

66.    It is my opinion, applying first principles of Auction Theory, that Google's Deceptive Conducts impact the entirety of Google's Display Advertising RTB Ecosystem and every single auction within it. Google's Display Advertising RTB Ecosystem was impacted by Google's Deceptive Conducts in at least three major respects, which are discussed below.

i.    **The RPO, DRS, and Bernanke Deceptive Conducts.**

67.    Over the course of multiple years and through similar means, three particular Deceptive Conducts, RPO, DRS, and Bernanke,[52] would have deceived advertisers into bidding their true value for an impression, and then in many cases charging them their value for that impression. Google claimed that AdX was running a truthful auction,[53] which deceived advertisers into bidding their true value, which was suboptimal due to RPO, DRS, and Bernanke.. DRSv1 and Project Bernanke[54] were deceptive, at least because AdX charged buyers their bid in a

_____

[52] See Sections VII , XII, XI  [RPO, DRS and Bernanke] of this report.

[53] Google also claims that GDN was optimizing on the advertiser's behalf

[54] Any variants with a first-price payment rule, including Buy-Side DRS.

particular window.[55] RPO was deceptive at least because AdX set future floors equal to past floors across the entire bid region. DRSv2 was deceptive at least because AdX charged advertisers *more than their bid* in a particular window[56]. It is my opinion that this demonstrates a sustained pattern of Deceptive Conduct that advertisers were deceived into bidding their true value and paying their value[57] wherever possible.

68. These Deceptive Conducts were not sufficiently disclosed to participants. Bernanke was never disclosed, RPO was insufficiently "disclosed."[58] [59] DRSv1 and DRSv2 were eventually deceptively "disclosed".[60]

69. Google repeatedly responded to "detections" by auction participants of its Deceptive Conduct with no meaningful information. Moreover, Google took active steps to further conceal its Deceptive Conduct when confronted with anomalies (███████████████████). These steps did not meaningfully remedy the Deceptive Conduct but avoided further detection of it.

70. Google introduced modifications to auction mechanics, such as debt (DRSv2 and tDRS, which is a deceptive mechanic), random perturbations (DRSv2 and RPO), and probabilistic throttling (Buy-Side DRS, DRS) to effectuate the Deceptive Conduct. Those modifications themselves constituted Deceptive Conducts.

71. If Google were transparent about these auction mechanisms, Google would not have benefited from them. The entire DRSv2 program generates no additional revenue for Google unless it can deceive some advertisers into bidding in the dynamic region. RPO runs a significant risk of inducing hyper-aggressive bid-shading unless Google could deceive some advertisers to ignore the impact of their current bids on future reserves. But Google launched both programs.

---

[55] For DRSv1, this is the dynamic region. For Project Bernanke, this includes the dynamic region and any auction where the GDN bidder would not have won but for the Bernanke boost.

[56] This is the dynamic region.

[57] Or very close to their value, in the case of RPO.

[58] See Jonathan Bellack. "Smarter optimizations to support a healthier programmatic market" (May 12, 2016).https://web.archive.org/web/20200929015943/https:/blog.google/products/admanager/smarter-optimizations-tosuppor/ I elaborate on the insufficient nature of the RPO disclosure in Section [RPO].

[59] See Expert Report of P. Milgrom, ¶174 ("[T]he confidential nature of Bernanke.")

[60] It is my opinion that the DRSv1 "disclosure" *prevented* advertisers from detecting DRSv1 rather than helping them. The DRSv2 "disclosure" contains a false material statement.

72.   In many cases, it is my opinion that Google took these actions with *intent* to deceive. For example, ████████████████████████████████████████████ ██████ ████████████████████████████████████████████████████████ For example, DRSv2 cannot possibly help Google, or anyone, without deception, yet Google developed and launched it. Internal emails demonstrate that Google responded to certain anomaly detections with intent to reveal as little information as possible.[61]

73.   In my opinion, the above examples of Deceptive Conducts demonstrate a long running pattern of deception.

### ii.   Google's Deceptive Conducts extended beyond Bernanke, DRS, and RPO.

74.   Google claimed that EDA was "opt-out" for publishers, but Google obscured this from them.[62] Google at no point describes Value CPMs as being a tool to set prices.[63] [64]

75.   Google's technology advantaged its products over non-Google products. This disparate treatment was never disclosed to non-Google Display Advertising RTB Ecosystems. [65,66]

---

[61] *See* GOOG-NE-05308018 at -18 ("'We can confirm that there isn't a first price auction on AdX at this time, and we're doing more investigation ████████████████. Please ensure that our customers aren't bidding higher than they are willing to pay as competition can be quite high for valuable users.'")

[62] *See* GOOG-DOJ-14141075 at -76 ("The default is EDA on, all new networks have it on. It can be turned off in ICS, but we don't want to mention it as an option.")

[63] *See* Google Ad Manager Help Center, "Value CPM." Available at: https://web.archive.org/web/20221202071803/https://support.google.com/admanager/answer/177222?hl=en ("an amount you specify to help Google Ad Manager estimate the value of campaigns. The amount entered in the "Value CPM" field serves two purposes: 1. It's used in revenue calculations for impressions served. 2. When a value CPM is defined for remnant line items, the value CPM is used for competition in dynamic allocation and First Look instead of the "Rate" value.") *See* also, Google, "Unified First-Price Auction - Best practices," p.5 ("To maximize yield and ensure the highest net eligible bids wins the impression, we recommend you set the value CPM of non-guaranteed line items to accurately reflect net bids/actual payouts. However, you can modify the value CPM of individual line items to reflect any other business objective."), available at: https://services.google.com/fh/files/misc/unified_first-price_auction_best_practices.pdf.

[64] Recall that some publishers did figure out that Value CPMs are a price-setting tool, and did "boost" them to increase AdX's reserve. Both the Weinberg Opening Report and the Milgrom Report cite evidence of this. *See* the Weinberg Opening Report, footnote 199 ("A sophisticated publisher could set the Value CPM however they like. If the publisher is sophisticated and revenue-maximizing, they would choose a Value CPM above the default. Recall that some publishers were indeed sophisticated and chose to do this. This is referred to as the 'boost.'"); Milgrom Report, ¶517 ("[T]here is evidence that publishers *did* boost header bids.")

[65] It is not surprising that these exemption policies were never shared with non-Google tools, as the Deceptive Conducts themselves were never disclosed.

[66] GDN was exempt from RPO, and this was never disclosed. *See* GOOG-DOJ-28486313 at -15 ("We would not commercialize the new exemption strategy.") GDN and DV360 were exempt from DRS, and this was never disclosed. *See* GOOG-DOJ-14380896 at -96 ("GDN/DBM is opted out of DRS.")

76.     In my opinion, this established that Google's Deceptive Conduct pervaded its Display Advertising RTB Ecosystem, beyond Bernanke, DRS, and RPO.

          **iii.   Google engaged in Deceptive Conduct by recruiting participants to its Display Advertising RTB Ecosystem with the misleading allure of simplicity.**

77.     Google recruited participants to its Display Advertising RTB Ecosystem with the misleading allure of simplicity. For example, Google described AdX as "a second price auction where the winner is the highest bid and the price is larger of the 2nd bid and the floor price,"[67] and GDN as "tak[ing] the heavy lifting and guesswork out of setting bids to meet your performance goals."[68] The Milgrom Report states that this alleged simplicity would recruit advertisers to the Display Advertising RTB Ecosystem.[69] Even if one were to grant the Milgrom Report and the Wiggins Report claim that advertisers were not deceived by Google's Deceptive Conduct, they were deceived to join the Display Advertising RTB Ecosystem in the first place.

78.     If I momentarily grant that somehow everyone in Google's Display Advertising RTB Ecosystem responded optimally to Google's Deceptive Conduct despite its deception, as the Milgrom Report claims, optimizing bids in a complex Display Advertising RTB Ecosystem is still a costly and complex task.[70] Even the most sophisticated players were deceived to join an allegedly simple Display Advertising RTB Ecosystem when in fact it is anything but.[71]

---

[67] GOOG-DOJ-29803801 at -04. ("The AdX Auction model is 2nd price, as described in the Help Center. AdX runs a second price auction where the winner is the highest bid and the price is larger of the 2nd bid and the floor price. In other words, the transaction price equals the price to beat to win the auction. This price is independent of the winner's bids.")

[68] *See* Google, "About automated bidding." October 9, 2018. Available at https://web.archive.org/web/20181009104917/https:/support.google.com/google-ads/answer/2979071?hl=en.

[69] *See* Expert Report of P. Milgrom, ¶65 ("Google recognized the advantages of bidder-truthful auctions, explaining them as follows: 'It's faster, less costly, and more fair to the less sophisticated advertisers to structure the auction in favor of true value.' **The lower transaction costs associated with bidding in a bidder-truthful auction encourage advertisers to participate on Google's platform**, which increases thickness, tending to improve the efficiency of its allocations and increase the prices paid to publishers." (*emphasis added*)

[70] *See* Expert Report of P. Milgrom, ¶252 ("each advertiser would face the complex task of identifying optimal bids on its own, which would require costly experimentation and engineering resources. Such experimentation was made more complicated by the presence of exchanges using dirty auctions, which sought to obscure their auction rules.")

[71] To explicitly place this in the "deception" framework, the decision a participant aims to optimize is "which ad buying tool should I use?", "which exchanges should I connect to?", or "Should I set up programmatic advertising at all or stick to traditional means?". Google's deception presents a low cost of using GDN and AdX, because it misrepresents their simplicity. This would cause participants to incorrectly choose Google products (or programmatic advertising entirely) in the first place due to their alleged simplicity.

79.  To get a sense of the complexity of Google's Display Advertising RTB Ecosystem, note that the Wiggins Report contains significant errors with respect to the DCMB Framework.[72] Even the Milgrom Report contains genuine errors.[73] Mistakes in analyses, like suboptimal behavior, arises due to the sheer complexity of Google's Display Advertising RTB Ecosystem.

80.  Finally, Google deceived participants to join its Display Advertising RTB Ecosystem in the first place by marketing simplicity when the Display Advertising RTB Ecosystem is anything but.

81.  The Wiggins Report proposes that Google's Display Advertising RTB Ecosystem is not deceptive because several features of the Ad Tech industry facilitate learning by advertisers. […]  These features include: (a) advertisers' use of sophisticated ad buying tools that provide them with metrics on their advertising effectiveness (such as return on ad spend), which advertisers generally use to learn and optimize over time; (b) advertisers' use of advertising agencies that help them evaluate returns and allocate budgets across ad buying tools; (c) competitive pressures for advertising dollars—rooted in the monitoring of returns by advertisers and agencies, as well as the simultaneous use of multiple ad buying tools—that incentivize ad buying tools to continually learn and adapt; (d) the presence of continuous and meaningful feedback; and (e) the ease with which advertisers, advertising agencies, and ad buying tools can conduct experiments. **The net impact of these factors is that advertisers need not, as a general matter, know all of the details about how Ad Tech optimizations and auctions operate.** [74] (*emphasis added*)

82.  The Wiggins Report appears to state that Google's Deceptive Conduct cannot mislead advertisers because Google correctly tells advertisers which impressions they won and how much they paid, which is the only information they need to rely on. [75,]

---

[72] *See* Section IV.

[73] *See* Section VI.

[74] Expert Report of S. Wiggins, ¶45.

[75] Expert Report of S. Wiggins, ¶45 ("[A]dvertisers need not, as a general matter, know all of the details about how Ad Tech optimizations and auctions operate.")

83. The Wiggins Report asserts that, armed with this information, advertisers cannot possibly be deceived.[76] Apparently, according to the Wiggins Report, Google could publicly state whatever false claims it likes, respond to private inquiries with further false claims, and take clever actions to make it more difficult for advertisers to discern the actual auction structures, advertisers will not be deceived as long as they learn which impressions they won and how much they paid.[77]

84. To support this assertion, the Wiggins Report states:

> [A]dvertisers, advertising agencies, and ad buying tools monitor performance and run experiments to help advertisers optimize their bidding strategies…The fact that advertisers continually monitor performance and learn to adopt optimal strategies based on their observations means that they would continue to do so regardless of whether RPO was publicly announced.[78]

85. But there is no evidence that such monitoring or experimenting frequently or typically detects Google's deceptive behavior.[79]

86. Even when Google's Deceptive Conduct is detected, Google responds by providing misleading responses and outmaneuvering advertisers and ad buying tools to avoid further detection.[80]

87. The Wiggins Report also appears to state that Google's Deceptive Conduct cannot mislead publishers if Google correctly tells the publishers who purchases their impressions and how much they pay.

---

[76] Expert Report of S. Wiggins, ¶45 ("The net impact of these factors is that advertisers need not, as a general matter, know all of the details about how Ad Tech optimizations and auctions operate.")

[77] The Baye Report explicitly states this as well "Because Google discloses to its customers that the actual amounts they pay are based on the outcomes of auctions, and that at the end of each month they will be provided an accounting of the amounts they pay or receive, customers are provided with all of the relevant price information they need from Google in order to comparison shop with competitive alternatives to Google's services." Expert Report of M. Baye, ¶596.

[78] Expert Report of S. Wiggins, ¶188.

[79] ███████████████████████████████████████████████████████████████████

[80] Google's response ██████ regarding DRSv2 contained a false statement regarding DRSv2, but also a useful statement regarding RPO. Google's response ██████ contained no material information, and suggested the anomalies were due to competition rather than Google's own Deceptive Conduct.

HIGHLY CONFIDENTIAL

88.　The Wiggins Report asserts that Google's Deceptive Conduct will not affect publishers' ability to optimize their strategies.[81] But when Google deceives publishers via its description of Value Cost Per Mille ("CPM"), publishers do not know which parameters set their desired prices. And when Google deceives via tDRS and RPO, publishers do not know how the price they think they're setting translates into the price that is actually set, nor do they know how to process the results of the auction.

**C.　Google's Conduct with Respect to Project Bernanke is Deceptive.**

89.　For Project Bernanke, the Wiggins Report considers a "but for" behavior that GDN bidders would have shaded their bids[82] "but for" Google's concealment of Projects Bernanke and Global Bernanke.[83]

90.　However, the Wiggins Report mistakenly concludes that "transactions won by Google Ads where non-Google Ads bidders set the clearing price" could not be affected if only GDN advertisers shaded their bids. This is false – GDN bid-shading could affect both the winning bidder and the clearing price of such transactions.[84] This example is reiterated in Section VIII.

91.　Under buy-side DRS (Bernanke's predecessor), Project Bernanke, and Project Global Bernanke (with first-price payment rule), GDN advertisers' optimal behavior entailed bid-shading.[85]

---

[81] Expert Report of S. Wiggins, ¶216.

[82] Bid-shading is the practice of a bidder placing a bid that is below what they believe an impression is worth.

[83] Professor Wiggins notes that Project Bernanke only applied to GDN, and this is therefore a sensible "but for" behavior that is supported by the Weinberg Opening Report.

[84] Here is a simple example where (a) a Google Ads bidder wins, (b) a non-GDN bidder sets the clearing price, and (c) if the Google Ads bidder were to bid-shade, this could change both (i) the clearing price, and (ii) the winning bidder. Imagine the top Google Ads bidder bids $12, the top non-GDN bidder bids $10, the AdX reserve is $8 (for everyone), and the second-top GDN bidder is $7. Then in this example, the GDN bidder wins, and a non-GDN bidder sets the clearing price (of $10.) If the top GDN bidder were to bid-shade to $9, then the impression would clear at $9 instead of $10, and the non-GDN bidder would now win. So, both the clearing price and winner have changed.

[85] This is reiterated in the Weinberg Opening Report, See Expert Report of M. Weinberg, Section VIII.E.2 ("Advertisers would have shaded their bids to maximize their payoff had they known about Projects Bernanke and Global Bernanke.") Google's experts do not dispute this claim. However, Google's experts dispute the Weinberg Framework that GDN advertisers *did not* bid-shade, and instead claim the Milgrom Report Framework that GDN advertisers *did* bid-shade. But they do not dispute that bid-shading is optimal. *See* Section III for a discussion of the Weinberg Framework and Milgrom Report Framework.

92.    Google presented GDN, and especially its "autobidding" functionality, as a tool to optimize yield on behalf of advertisers.[86] This suggests that advertisers should share their true objectives with GDN and "trust GDN" to optimize on their behalf. The Wiggins Report notes that GDN advertisers did just this.[87]

93.    Advertisers who use GDN's "autobidding" functionality provided input to GDN[88] and expected GDN to optimize bids on their behalf. Advertisers would expect this optimization to be included as a function of an ad buying tool because Google describes its autobidding functionality using phrases such as "allow Google Ads to *automatically* optimize bids."[89] (*emphasis added*)

94.    Advertisers who directly set bids in GDN would believe that they are directly bidding into a second-price auction.[90] No communications from Google suggest otherwise.

---

[86] *See* Google, "About automated bidding." October 9, 2018. Available at https://web.archive.org/web/20181009104917/https:/support.google.com/google-ads/answer/2979071?hl=en ("Automated bidding takes the heavy lifting and guesswork out of setting bids to meet your performance goals.".)

[87] Expert Report of S. Wiggins, ¶50 ( ███████████████████████████ ███████████████████████████ ███████████████████████████ This is also supported by a Google employee's deposition. Deposition of N. Jayaram, p.127 ("I would say that the advertisers are giving us a budget and trusting us to deliver the best performance that we can deliver.")

[88] For example, GDN asks for a budget, an objective to focus on (i.e. conversions), whether to use an automated strategy or manual bidding, and whether to assign a target cost to certain actions (i.e. set a target 'cost per action'.) Along the way, notifications let the advertiser know "This campaign will use the [name of a strategy] strategy **to help you get the most** [objective selected] for your budget." *See* GurmitT, "Run ads without conversion tracker." (*Emphasis added*). Google, May 18, 2024. https://support.google.com/google-ads/thread/275119081/run-ads-without-conversion-tracker?hl=en.

[89] *See* Google, "About automated bidding." October 9, 2018. Available at https://web.archive.org/web/20181009104917/https:/support.google.com/google-ads/answer/2979071?hl=en ("By adding those keywords to a portfolio Target CPA bid strategy and setting a CPA goal you want to hit, **you allow Google Ads to automatically optimize bids** across keywords using advanced machine learning to get you more conversions within your performance target."; "You choose another advertiser's domain you want to outrank in ad position and how often you want to outrank it, and **Google Ads automatically sets your Search bids to help meet that target**."; "Smart Bidding is a set of conversion-based bid strategies—Target CPA, Target ROAS and Enhanced CPC—that use advanced machine learning **to help you tailor the right bid to each and every auction**." *(emphasis added)*)

[90] One reason advertisers believe this is that Google describes the option to "select a bid strategy directly." *See also* Google, "Set up smart bidding." Available at: https://support.google.com/google-ads/answer/10893605?hl=en.

95. Neither the Milgrom Report not the Wiggins Report describe any experimentation by advertisers that would plausibly detect a first-price payment rule in GDN.[91] [92]

96. In addition, ad buying tools are generally marketed as taking care of the "auction dynamics" on behalf of advertisers; it would be contrary to the purpose of an ad buying tool if advertisers still needed to strategize optimal inputs to their ad buying tool.[93]

97. Finally, with Buy-Side DRS (Bernanke's predecessor), Google also used a technique called "probabilistic throttling" so that "the advertiser will not be able to change his strategy to significantly affect the outcome."[94]

98. Google's decision not to disclose Buy-Side DRS, Project Bernanke, or Project Global Bernanke (with first-price payment rule) would have caused GDN advertisers to report their true values to GDN, when they would be better off bid-shading.[95]

99. It is also my opinion that bidding one's true value into a "dirty" second-price auction, as opposed to optimally bid-shading, is suboptimal. Therefore, it is my opinion that Google's conduct with respect to Buy-Side DRS, Project Bernanke, and Project Global Bernanke (with first-price payment rule) is deceptive and harmful to GDN advertisers.

100. Google also misrepresented GDN to publishers, and this misrepresentation would affect how publishers set optimal reserves. In particular, publishers would have raised reserves on GDN if they knew about Project Bernanke (all forms – including the Alchemist).[96]

---

[91] I also understand an advertiser using the "autobidding" feature does not even have the necessary information for *any* experiment to detect a first-price payment rule, because such advertisers do not even know their value – they rely on GDN to compute their value in the first place.

[92] The Milgrom Report and Wiggins Report claim that advertisers regularly *evaluate the performance of their ad buying tools*, including GDN (*See* Expert Report of P. Milgrom, ¶30-31; Expert Report of S. Wiggins, ¶65-67..) Such evaluations are fundamentally different than experiments that instead aim to *optimally interact with* GDN.

[93] *See* Expert Report of S. Wiggins, ¶ 46 ("These ad buying tools greatly simplify advertiser decision-making because they choose the impressions on which to bid and prepare and submit bids into auctions. This means that instead of focusing on auction dynamics, the impressions to bid on, and how much to bid, advertisers can simply assess the cost effectiveness of and returns generated by these ad buying tools.")

[94] GOOG-AT-MDL-013107815 at -15 ("If for every adgroup, we limit the fraction of auctions where first pricing occurs to some small number, then the advertiser will not be able to change his strategy to significantly affect the outcome.")

[95] In this scenario, the "direct bidders" would bid-shade, while "autobidders'" would instead shade their CPC, CPA, or other parameters.

[96] But not including Buy-Side DRS, as Buy-Side DRS did not have a "collusion" aspect, meaning there was no bid-dropping mechanism involved.

101. This even includes publishers who optimally process the winning bid data on all auctions. When a publisher processes winning bid data on a concluded auction from multiple competitive advertisers, they seek to determine the bid distribution of a single advertiser as this information determines the optimal reserve for a second-price or first-price auction using Myerson's theory of optimal auctions.[97] In nondeceptive circumstances, a publisher should process all available data to reverse engineer the bid distribution *of a single advertiser* rather than just the bid distribution *of the winning advertiser*. The "collusion" aspect of Project Bernanke ruins this process in two ways.[98]

102. First, if a group of advertisers colludes in either a second-price or first-price auction, publishers should price that group as a single bidder.[99] Therefore, a publisher processing bids from an ad buying tool that drops bids should set prices based only on the bid distribution of the winning advertiser instead of a single advertiser.

103. Second, even if a publisher sets prices based on the bid distribution of the winning advertiser, the process for reverse-engineering that single advertiser's bid is corrupted because, under Project Bernanke (all forms during which AdX ran a second-price auction), publishers would reasonably believe that GDN's two submitted bids are its two highest advertiser bids and process them as such. But in fact, it was optimal for publishers to process Google's Bernanke-tainted bids differently.

104. Similarly, Google's concealment of the Alchemist is deceptive to publishers because publishers would reasonably believe GDN's top submitted bid to be optimized against the entire bidding population rather than just non-GDN bidders. This, again, would cause a publisher processing winning bid data to optimize incorrectly.

---

[97] Myerson, Roger B. "Optimal auction design." *Mathematics of operations research* 6.1 (1981): 58-73.

[98] I acknowledge that the Milgrom Report objects to my use of the phrase "collusion" to describe this aspect of Project Bernanke. While it is still my opinion that 'collusion' is an entirely appropriate term to describe this aspect of Project Bernanke (and justify this in Section VIII, it is immaterial for this claim whether we term this aspect "collusion" or "coordination" or "bid-dropping" – I am simply referring to a technical aspect of Project Bernanke.

[99] To have an extreme example in mind, imagine that an auction has 1000 advertisers, and imagine that the publisher believes all values to be drawn uniformly and independently from [0,1]. Then the optimal auction with no collusion is a second-price auction with reserve 1/2. With collusion among all 1000 advertisers, a second-price auction with reserve 1/2 achieves revenue at most 1/2 (because the colluders would never second-price themselves.) A better option with colluding advertisers would be to treat them as a single bidder whose value is drawn according to the maximum of 1000 independent and uniform draws from [0,1]. The optimal reserve in this case is much closer to 1 and would result in revenue close to 1 (for example, a reserve of 0.99 would clear with probability 99.99% -- the optimal reserve can only be better.)

105.  In sum, the collusive aspect of Project Bernanke (a) corrupts the process of reverse-engineering a single advertiser's value distribution to optimally set its reserve, so the publisher's estimate would be inaccurate, and (b) makes this the wrong objective anyway as the publisher should instead be pricing the entire pool of GDN advertisers as a single bidder.

106.  Google's conduct with respect to Project Bernanke is: (a) deceptive towards advertisers during all periods when Buy-side DRS/Project Bernanke used a first-price rule, and (b) deceptive towards publishers during all periods. [100] The primary mechanism of deception is concealing a vital auction mechanic that any reasonable auction theorist would consider vital and that could be easily disclosed.

### D.    Google's conduct with respect to DRS is deceptive.

107.  Google's conduct with respect to DRS is deceptive towards advertisers and publishers.

108.  Towards advertisers, Google's Deceptive Conduct surrounding DRSv1 is deceptive, because Google's Deceptive Conduct would encourage advertisers/ad buying tools to bid their true values instead of bid-shading in the dynamic region.

109.  Towards advertisers, Google's Deceptive Conduct surrounding DRSv2 is deceptive, as Google's deceptive behavior would encourage advertisers/ad buying tools to bid within the dynamic region rather than skip it entirely, causing advertisers to pay more than their value for impressions.

110.  Advertisers and their ad buying tools would believe AdX to be running a second-price auction, as this is what Google claims.[101] At minimum, advertisers would believe AdX to be running a truthful auction, and therefore would bid their values into AdX.

111.  For DRSv1, when advertisers win a bid in the dynamic region, they were charged their bid. Therefore, an optimal advertiser would bid-shade in this region.

---

[100] To repeat, (b) excludes Buy-Side DRS, because Buy-Side DRS does not have a "collusive" aspect.

[101] GOOG-DOJ-29803801 at -04. ("The AdX Auction model is 2nd price, as described in the Help Center. AdX runs a second price auction where the winner is the highest bid and the price is larger of the 2nd bid and the floor price. In other words, the transaction price equals the price to beat to win the auction. This price is independent of the winner's bids.")

112. For DRSv2, when advertisers win a bid in the dynamic region, they ultimately end up paying Google's reserve, which is more than their bid.[102] This is suboptimal behavior.

113. Google engaged in several Deceptive Conducts that would cause advertisers to continue bidding their true value instead of bidding optimally.[103]

    i.   First, DRSv2 uses a "1.5-price" rule in the dynamic region to obscure the fact that the winner's immediate payment is impacted by their bid.[104] Even the Milgrom Report considers the 1.5-price rule to be deceptive.[105]

    ii.   Second, Google used a technique called "probabilistic throttling" "to prevent buyer and seller abuse."106

    iii.   Third, Google's statement that "[b]uyers are never charged more than their bid"107 is false under DRSv2, as noted above.108

---

[102] This is stated in the Weinberg Opening Report (*See* Expert Report of M. Weinberg, ¶206, "when an advertiser submits a winning bid in the 'dynamic region' (i.e., a bid between the publisher-set reserve of r and the effective reserve of r/0.8), the advertiser not only pays their bid now resulting in a payoff of 0, but further accumulates debt that must be paid later.".)  The Milgrom Report does not contest this claim. Moreover, the Milgrom Report also acknowledges this: "This means that, after accounting for later debts paid, the effective price of an impression cleared by DRS v2 for the buyer is equal to the floor price that would apply in the absence of DRS v2." Expert Report of P. Milgrom, ¶443. As the submitted bid is less than the floor price that would apply in the absence of DRSv2, this is stating that the effective price is more than the advertiser's bid.

[103] ████████████████████████████████████████████████████████████████████████

[104] And remember, DRSv2 is even more deceptive than this, because the winner also accumulates debt.

[105] *See* Expert Report of P. Milgrom, ¶69 ("Another example, relevant in online display advertising, is a non-transparent auction, in which the auctioneer might claim to calculate winners and payments according to one rule, but actually charges bidders according to another rule. Because it is so easy to detect the first-price rule, **an auctioneer running a non-transparent auction might claim to use a second-price auction but actually use the 1.5-price rule**, hoping to confuse bidders into bidding too much, increasing the auctioneer's profit." (*Emphasis added*))

[106] *See* GOOG-14368357 at -57 ("We **limit how often we reduce the margin to maintain** ████████ **average margin** and to prevent buyer and seller abuse.") (*emphasis added*) In this context "buyer and seller abuse" means the buyers and sellers best responding to the auction mechanics, as they should in any auction setting.

[107] GOOG-TEX-00858434 at -37.

[108] This is stated in the Weinberg Opening Report (*See* Expert Report of M. Weinberg, ¶206, "when an advertiser submits a winning bid in the "dynamic region" (i.e., a bid between the publisher-set reserve of r and the effective reserve of r/0.8), the advertiser not only pays their bid now resulting in a payoff of 0, but further accumulates debt that must be paid later.") The Milgrom Report does not contest this claim. Moreover, the Milgrom Report also acknowledges this: "This means that, after accounting for later debts paid, the effective price of an impression cleared by DRS v2 for the buyer is equal to the floor price that would apply in the absence of DRS v2." Expert Report of P. Milgrom, ¶443. As the submitted bid is less than the floor price that would apply in the absence of DRSv2, this is stating that the effective price is more than the advertiser's bid.

iv.   Fourth, ████████████████████████████████████████, about DRSv2, Google responded by (a) repeating the same false claim that "[t]he transaction price is always less than or equal to the buyer's bid,"110 (b) not revealing additional information of value regarding DRSv2,111 and (c) ████████████ ████████████████████████████████████████████████████ ████████████████████████████████

v.   Fifth, Google's "disclosure" of DRSv2 is itself deceptive. The Milgrom Report notes a "disclosure" by Google on DRSv2. 114 This disclosure includes the statement "[r]egardless of whether any adjustments are made, the winning buyer will never be charged more than the bid it submits," which is false under DRSv2.115

vi.   Sixth, Google's "disclosure" of DRSv1 is also itself deceptive. The Milgrom Report also notes a "disclosure" by Google on DRSv1, which simply states that

---

109 GOOG-DOJ-15426070 at -78. Criteo initiates the thread with a concern: "Our team has found data suggesting that there is dynamic pricing [...] It looks like dynamic pricing starts from PMP floors and follows a (floor+bid)/2 line." On thread, Google researchers discover "This is very interesting to see the DRSv2 effects are visible outside. I do believe this is DRSv2 [...] buyer debt recollection."

110 GOOG-AT-MDL-004416785 at -85.

111 GOOG-AT-MDL-004416785 at -85 ("Q: What is the rationale behind bidders having the possibility to win below the floor passed? A: Revenue share based optimizations increase match rate and provide buyers more access to seller inventory with high floors. Q: What is the condition for a bidder to be able to win when submitting a bid below the floor? Is there a minimal value to bid in percentage of the floor? A: These are parameters that we tune over time. If a buyer bids below the floor, we may choose to clear the query at a reduced rev share. Q: How is the price paid by a winner bidding below the floor determined? A: The transaction price is always less than or equal to the buyer's bid.")

██ ████████████████████████████████████████████████████████████████ ████████████████████████████████████████████████████████████████ ████████████████████████████████████████████

██ ████████████████████████████████████████████████████████████████ ████████████████████████████████████████████████████████████████ ████████████████████████████████

114 See Expert Report of P. Milgrom ¶ 468 ("Before the launch of DRS v2, the Help Center page was updated to include the possibility that some impressions would close above or below the contracted revenue share, while still ensuring that publishers would receive at least their contracted revenue share in a given month.")

115 This is stated in my Opening Report (See Expert Report of M. Weinberg, ¶206, "when an advertiser submits a winning bid in the "dynamic region" (i.e., a bid between the publisher-set reserve of r and the effective reserve of r/0.8), the advertiser not only pays their bid now resulting in a payoff of 0, but further accumulates debt that must be paid later.".) The Milgrom Report does not contest this claim. The Milgrom Report also acknowledges this: "This means that, after accounting for later debts paid, the effective price of an impression cleared by DRS v2 for the buyer is equal to the floor price that would apply in the absence of DRS v2." Expert Report of P. Milgrom, ¶443. As the submitted bid is less than the floor price that would apply in the absence of DRSv2, this is stating that the effective price is more than the advertiser's bid.

"[i]n some cases, the auction may close at a price lower than the reserve price applied, due to auction optimizations."[116] In my opinion, this disclosure is deceptive because it highlights one anomaly that advertisers might notice due to DRSv1 (winning below the reserve and paying your bid), and dismisses it as "auction optimizations." This would discourage advertisers from investigating anomalies, and possibly discovering ways to optimize bids under DRSv1.

███████████████████████████████████████████████████████
███████████████████████████████████████ [118]

114. Contrary to claims in the Milgrom Report,[119] it does not appear that any ad buying tools "detected" DRSv1. It appears that no concerns were raised by any advertiser regarding DRSv1, and the Milgrom Report provides no evidence of any ad buying tool detecting DRSv1.[120]

███████████████████████████████████████████████████████
███████████████████████ █████████████████████████

115. ████████████████████████████████████████████ █ ████████████
████████████████████████████████

---

[116] *See* Expert Report of P. Milgrom ¶ 468.

█ ████████████████████████████████████████████████████████
████████████████████████████████████████████████████████

[118] GOOG-NE-06835928 at -29 ("To optimize the auction for the purpose of maximizing publisher revenue and buyer return on investment, we are continually exploring changes in the DoubleClick Ad Exchange. As we develop new ways to improve the exchange for buyers and sellers, we want to make sure our Help Center documentation remains accurate and accounts for behavior you might see due to optimization. Recently, we launched a small update to the main auction dynamics article, we encourage you to review the changes.")

[119] Expert Report of P. Milgrom ¶ 469 ("A minimally attentive buyer who failed to read Google's disclosure could still discover DRS by noticing when a bid below the floor price was accepted at a price equal to its bid and, by applying logic or just conducting routine experiments, optimize its bidding strategy to account for that possibility.")

[120] *See* GOOG-DOJ-15426070 at -76 ("[T]he bid price correlations in DRS v1 (bid=price in the dynamic region) are stronger ███
█████████████████████".) *See also* GOOG-AT-MDL-B-006338037 at -37 ("I am reaching out to you to ask if you have received or aware of external inquiries specific to these 2 features [DRS or RPO] [...] I am currently not aware of any additional external enquiries on the subject.")████████████████████████████████
████████████████████████████████████████████████████████
█ ████████████████████████████████████████████████████████
████████████████████████████████████████
█ ████████████████████████████████████████████████████████
█ ████████████████████████████████████████████████████████
███████████████████████████████

116. Internal Google communications state this was the only inquiry received regarding DRSv2.[127]

117. ████████████████████████████████████████████████████████████
████████████████ only resulted in further Google Deceptive Conduct.

118. Accordingly, in my opinion and based on Auction Theory, Google's Deceptive Conduct surrounding DRSv1 was deceptive towards advertisers, as its actions caused advertisers to bid their values instead of optimally shading their bids, and Google's Deceptive Conduct surrounding DRSv2 was deceptive towards advertisers, as its actions caused advertisers to pay more than their bid for impressions. Google engaged in this Deceptive Conduct through multiple sustained avenues, including false and/or misleading communications, false and/or misleading private responses, the deceptive "debt" mechanic, and random perturbations to avoid future detection.

119. Towards publishers, Google's Deceptive Conduct surrounding DRSv1, DRSv2, and tDRS is deceptive, for the following reasons.

---

[127] *See* GOOG-AT-MDL-B-006338037 at -37 ("I am reaching out to you to ask if you have received or aware of external inquiries specific to these 2 features [DRS or RPO] [...] I am currently not aware of any additional external enquiries on the subject.")

    **i.**    Like advertisers, publishers would believe AdX to be running a second-price auction, their price floor to be the minimum payment received, and AdX to take a 20% revenue share.[128]

    **ii.**    If publishers were aware of DRSv1, an optimal publisher would have raised their price floor on AdX.[129]

    **iii.**    tDRS functionally allows Google to lower the publisher's price floor by up to 20%.[130] If publishers were aware of tDRS, an optimal publisher would have raised their price floor on AdX.

    **iv.**    Google states: "We always pay publisher at least their reserve." [131,132] After accounting for debt, this is false for tDRS, and misleading for DRSv2.[133] Under tDRS, Google pays publishers up to 20% less than their price floor (and obscures this via debt – the publisher will appear to receive their price floor on the impression via direct payment but pay back up to 20% of this later). Under DRSv2, each publisher is indeed paid at least the total price floors on all cleared AdX transactions.[134] Because the marginal contribution of an individual transaction can be less than its price floor (depending on how the winning advertiser's debt is recollected), this claim is misleading.[135]

---

[128] See GOOG-AT-MDL-001004706 at -42 ("Baseline revenue share is 80/20 which means that of every dollar an advertiser pays (Gross value), 80 cents go to publisher and 20 cents go to Google.").

[129] I state and justify this in the Weinberg Opening Report. *See* Expert Report of M. Weinberg, Section VII.D.1. The Milgrom Report does not contest this claim, as the report contests the Weinberg Report Framework, which posits that ███████████ with the Milgrom Report Framework, which posits that ███████████ . *See* Expert Report of P. Milgrom ¶ 469. But the Milgrom report does not contest that optimal publisher behavior in response to DRSv1 is to raise floors.

[130] I state this in the Weinberg Opening Report (see Expert Report of M. Weinberg, ¶223), and the Milgrom Report does not contest this claim.

[131] GOOG-AT-MDL-004416785 at -87.

[132] GOOG-TEX-00858434 -at 40 ("Before or after the July change, we still do NOT pay publishers below publisher's floor.")

[133] I state both of these claims in the Weinberg Opening Report, and the Milgrom Report does not contest either of them. Expert Report of M. Weinberg, ¶231.b "For DRSv2, Google states: 'sellers are always paid at least their reserve.' I find this claim misleading to publishers." Expert Report of M. Weinberg, ¶231.d "In a Google communications document, that seems to have been active after tDRS launched, Google states Before or after the July change, we still do NOT pay publishers below publisher's floor… (GOOG-AT-MDL-B-004124703 at -09) I find this claim quite misleading to publishers concerning tDRS.

[134] This follows from the definition of DRSv2. See Expert Report of M. Weinberg, ¶198; Expert Report of P. Milgrom, ¶439.

[135] See Expert Report of M. Weinberg, ¶218.

    **v.**   Google did allow publishers to "opt out" of DRSv2,[136] but given that publishers were misled to believe they would always be paid at least their price floor under DRSv2, publishers could not make a fully-informed decision on whether to opt out of DRSv2. Google's imperfect "opt-out" does not remedy that Deceptive Conduct.

120.   Accordingly, based on Auction Theory and fact, all variants of DRS are deceptive towards publishers for the following reasons: (a) publishers would have increased their price floors if they knew about DRSv1 and tDRS, and (b) publishers would have believed they would always be paid their price floors under DRSv2 and tDRS, but this was false (and publishers may also have raised their price floors if they knew).

121.   In summary, it is my opinion, based on Auction Theory, that Google's Deceptive Conduct with respect to DRSv1 was deceptive towards advertisers, and its Deceptive Conduct with respect to DRSv2 was deceptive towards advertisers. It is also my opinion that Google's Deceptive Conduct with respect to all DRS variants is deceptive towards publishers. The mechanisms by which Google engaged in Deceptive Conducts are: (a) false statements in communications, including private communications explicitly raising concerns about DRSv2, (b) the deceptive debt mechanism, (c) ███████████████████ simply avoiding future detection rather than materially changing/revealing the Deceptive Conduct, (d) launching an entire program that requires deception to have any impact at all (DRSv2), and (e) "disclosures" that are themselves deceptive (DRSv1, DRSv2 – the DRSv2 "disclosure" even contains a material false statement).

### E.    Google's conduct with respect to RPO is deceptive.

122.   In my opinion, Google's conduct with respect to RPO is deceptive towards advertisers and publishers. If advertisers fully understood RPO, they would significantly shade their bids. ███ ████████████████████████████ ██ ███████████████ ████████████████████████ Therefore, bidding one's true value into RPO is suboptimal.

---

[136] GOOG-NE-04934281 at -86.

[137] That is, when bids from the same advertiser do not change from day to day (which would result from an advertiser bidding their true value, when their value does not oscillate much day to day.)

██ ███████████████████████████████████████████
████████████████████████████

123. The Wiggins Report considers, for both DRSv1 and RPO, a "but for" behavior that non-GDN bidders would shade their bids, but for Google's concealment of DRSv1 and RPO. [139,140]

124. However, the Wiggins Report concludes that "all AdX transactions for which a Google Ads bid set the clearing price (regardless of whether Google Ads or another bidder won)" could not be affected if only non-GDN advertisers shaded their bids.[141] This is false – non-GDN bid-shading could affect both the winning bidder and the clearing price of such transactions.[142] This example is repeated in Sections XII and XI.

125. In addition, the Wiggins Report erroneously attempts to quantify the "but-for" bid-shading that would occur if Google communicated RPO transparently. The Wiggins Report likens bid-shading in RPO to bid-shading in a first-price auction, ████████████████████████████

████████████████████████████████████████████████████████████

████████   This is erroneous because bid-shading in RPO is nothing like bid-shading in a first-price auction. Bid-shading in a first-price auction is a one-shot tradeoff between probability of outbidding others (higher bids are more likely to win) and price paid (lower bids pay less when winning). Bid-shading in RPO is a completely different tradeoff between optimizing payoff from this auction (closer to your true value is better) and future reserves AdX might set based on this bid (lower bids now yield lower future reserves later). In settings similar to RPO,

---

[139] Professor Wiggins notes that GDN was exempt from DRSv1 and RPO, (*See* Expert Report of S. Wiggins, ¶¶195, 217), and this is therefore a sensible "but for" behavior that is supported by my Opening Report.

[140] *See* Expert Report of S. Wiggins, ¶146 ("Because Google Ads was exempt from RPO, there is no reason to believe—and neither Mr. Andrien nor Professor Weinberg provides any evidence, or even asserts—that advertisers using Google Ads would have bid differently absent the alleged deception.")

[141] *See* Expert Report of S. Wiggins, ¶147 ("As a result, I exclude from the number of transactions potentially affected by the alleged deception about RPO (i) all AdX transactions for which a Google Ads bid set the clearing price (regardless of whether Google Ads or another bidder won); and (ii) all AdX transactions that Google Ads won and where a price floor set the clearing price.")

[142] Here is a simple example where (a) a non-Google Ads bidder wins, (b) a Google Ads bidder sets the clearing price, and (c) if the non-Google Ads bidder were to bid-shade, this could change both (i) the clearing price, and (ii) the winning bidder. Imagine the top non-GDN AdX bidder bids $12, the top GDN bidder bids $10, the AdX reserve is $8 (for everyone), and the second-top non-GDN bidder is $7. Then in this example, the non-GDN bidder wins, and a GDN bidder sets the clearing price (of $10.) If the top non-GDN bidder were to bid-shade to $9, then the impression would clear at $9 instead of $10, and the GDN bidder would now win. So, both the clearing price and winner have changed.

Auction Theory would predict that bids should be shaded at 100% (that is, the seller wins up with zero revenue). [143,144]

126. The Wiggins Report errs when concluding that "all AdX transactions that Google Ads won and where a price floor set the clearing price" could not be affected if only non-GDN advertisers shaded their bids.[145] This is also false because bid-shading in past auctions could lower the RPO reserve in this auction, which could affect both the winning bidder and the clearing price of such transactions.[146] [147] This example is repeated in Section XI.

127. Google's purported "disclosure" of RPO was insufficient. Google's "disclosure" primarily overviewed that setting prices closer to the maximum buyer value will increase publishers' revenue, and did not discuss how RPO affects buyer incentives at all. ████████████ ███████████████████████████.[148] As a result, Google's "disclosure" is not relevant when discussing Google's Deceptive Conduct.

---

[143] *See* Devanur, Nikhil R., Yuval Peres, and Balasubramanian Sivan. "Perfect bayesian equilibria in repeated sales." *Games and Economic Behavior* 118 (2019): 570-588; Hart, Oliver D., and Jean Tirole. "Contract renegotiation and Coasian dynamics." *The Review of Economic Studies* 55.4 (1988): 509-540; Schmidt, Klaus M. "Commitment through incomplete information in a simple repeated bargaining game." *Journal of Economic Theory* 60.1 (1993): 114-139. Although these models are not literally modeling RPO, their findings hold generally and are therefore a much better starting point to estimate RPO's "but-for" bid-shading factor than Project Poirot. This reasoning, including manners in which this research captures RPO (and their limitations) is expounded upon in Section XI.

[144] The Wiggins Report actually claims the *opposite* -- that RPO bid-shading would be *less* than first-price bid-shading. The Wiggins Report justifies this with two claims: (a) strategic agents (including advertisers) tend to discount future profits compared to present profits and (b) advertisers do not pay their bid under RPO, but a price less than their bid. *See* Expert Report of S. Wiggins, ¶318. Both of these claims are true, and I understand why one might reasonably conjecture that RPO bid-shading would be less than first-price bid-shading due to intuition derived from these claims. However, several academic papers have 'done the math' and come to the opposite conclusion. While these academic papers do not perfectly capture RPO, they are a significantly more thorough starting point than a paragraph of intuition. (To get intuition for why these academic papers conclude the opposite, it is because a lower bid now lowers my reserve in *multiple* future auctions, whereas a higher bid now only helps me win this single auction.).

[145] The Wiggins Report makes this same claim for DRSv1. I do not detect logical flaws with his claim that non-GDN bid-shading on a single transaction would not affect a transaction that GDN wins and whose price is set by a price floor. *See* Expert Report of S. Wiggins, ¶ 147.

[146] Here is a simple example where (a) Google Ads won, (b) a price floor set the clearing price, and (c) if a non-GDN bidder were to bid-shade in response to RPO, this could change both (i) the clearing price and (ii) the winning bidder. Consider an example where the top GDN bid is $12, the GDN reserve is $10, the top non-GDN bid is $15 and the non-GDN RPO reserve is $20. Then in this example, the top GDN bid wins, and the clearing price ($10) is set by the GDN price floor. If the non-GDN bidder bid-shaded *in previous auctions* in response to RPO, this would lower their RPO reserve *in this auction*. That is, bid-shading in response to RPO could lower the non-GDN RPO reserve to (say) $10, and the non-GDN bidder could win this auction with a bid of (say) $13. This would change both the clearing price (from $10 to $12) and winner (from GDN to non-GDN.)

[147] I do note, however, that this impact could not *lower* the clearing price, but it could certainly affect the clearing price (and in any case, it can certainly affect the winning bidder.)

[148] ███████████████████████████████████████████████████████████████ ██████████.")

128. Google concealed RPO. This is Deceptive Conduct towards advertisers.

129. The Milgrom Report claims that, absent RPO, publishers could set dynamic prices, and therefore advertisers could have reason to worry that their past bids could be affecting their future reserves.[149] However, RPO made dynamic pricing significantly more widespread (as evidenced by RPO's revenue lift).[150] Moreover, the particular tactics of RPO target future reserves of one buyer using their own past bids,[151] and so it is reasonable to expect that Google would outperform a representative publisher in terms of dynamic pricing strategies. And finally, the Milgrom Report further notes that prior to RPO, and even with a "Minimum CPM Recommendation" feature provided by Google, "[t]he publisher still needed to set the floor price manually in the AdX user interface based on its recommendations."[152] But the threat of dynamic pricing from manually-entered floors is not comparable to the greater threat of automated dynamic pricing by Google.

130. Based on Auction Theory, Google's concealment of RPO alone is Deceptive Conduct towards advertisers. Google also engaged in further Deceptive Conduct regarding RPO. First, Google communications suggest that bidders continue bidding their value after announcing RPO,[153] and that RPO applies to AdWords, even though AdWords is exempt.[154] Second, while there were exemption policies in place (because Google wished to exempt its own ad buying tools),[155] these policies were not publicly communicated.[156] Third, ███████████

---

[149] Expert Report of P. Milgrom, ¶414 ("in *any* auction setting involving repeated interactions, a buyer or seller needs to account for the possibility that another auction participant might learn from its past behavior and use that information in future interactions.")

[150] ███████████████████████████████

[151] *See* Expert Report of P. Milgrom, ¶400 ("The first RPO model (sometimes called Per-Buyer RPO) increased floor prices on a per-buyer basis, using data on the buyer's bids on a publisher's ad slot from the previous day to estimate the floor price that maximized the expected auction revenue.")

[152] Expert Report of P. Milgrom, ¶397. the Milgrom Report further provides the following reference: Design Doc, "Dynamic Floor Prices in AdX" (Aug. 20, 2012), GOOG-AT-MDL-010338120, at -120 ("Floor prices in AdX are set manually per ad unit (or, in the brave new adunitless world, per inventory rule.) Either way, the min cpm is set by a human entering a number into a text box in the adseller Ul.")

[153] GOOG-DOJ-AT-02323144 at -49 ("Q: How does this change things for me as an Open Auction buyer? Should I adjust my bidding algorithm? A: Ensure you're always bidding the value of the auction to you.")

[154] GOOG-DOJ-AT-02323144 at -50 ("Q: Does optimized pricing apply to all buyers in the AdX Open Auction, including AdWords? A: All Open Auction buyers on AdX, including AdWords, are subject to optimized pricing, there is no opt out.")

[155] GOOG-DOJ-28486313 at -15 ("The intent is to come up with a reasonably-looking policy by which adwords would be exempt by a comfortable margin, while buyers who do not submit multiple bids would not be exempt.")

[156] GOOG-DOJ-28486313 at -15 ("We would not commercialize the new exemption strategy.")

[black redaction bar]

Fourth, [black redaction] [158]

[black redaction]

131. In my opinion, Google's Deceptive Conduct, with respect to RPO, far outweighed any actions that might be considered transparent.[160]

132. In summary, given Google's combination of not disclosing RPO, modifying RPO to be more difficult to detect, and deceptively responding to inquiries, Google's actions towards advertisers constitutes Deceptive Conduct. This is the case for the duration of RPO's existence, rather than only the time period before its "disclosure" because the "disclosure" is not meaningful.[161]

133. The mechanisms by which Google engaged in Deceptive Conduct are: (a) uninformative responses in private communications with customers explicitly raising concerns about RPO;

---

[157] Let me also observe that this is not a particularly sophisticated "experiment" of the type that the Milgrom Report and the Wiggins Report suggest is widespread in Google's Display Advertising RTB Ecosystem – Intage simply observed that their reserve seems to track 95% of their bid, even as the bid changes. GOOG-NE-05308018 at 19. Indeed, Google avoided future detection by simply adding random noise to the RPO reserve. *See* GOOG-AT-MDL-012331940 at -40.

[158] [black redaction]

[159] [black redaction]

[160] For example, Google's internal guidelines for communicating RPO state "To price as intelligently as possible, all event level data from past Open Auctions may be considered (subject to contract terms.) This means a buyer's historic bids may be used as part of the prediction model to set a price for them." (GOOG-AT-MDL-001391101 at -06). But, this same document also encourages advertisers to bid their true value, and falsely claims RPO applies to AdWords.(GOOG-AT-MDL-001391101 at -06-07). Google [redaction] "Q: How does optimized pricing react to flat bidders? A: […] All else equal, flat bidders are likely to face more aggressive pricing.". But, the same document falsely claims that buyers are never charged more than their bid under DRSv2. ("Q: How is the price paid by a winner bidding below the floor determined? A: The transaction price is always less than or equal to the buyer's bid." GOOG-AT-MDL-004416785 at -85-86). Even within the context of each document in isolation, the Deceptive Conduct far outweighs actions that may be considered transparent. Google's broader Deceptive Conduct only amplifies this.

[161] The Wiggins Report agrees the "disclosure" is not meaningful [redaction]. *See* Expert Report of S. Wiggins, ¶206 ("[redaction].")

(b) ██████████████████████████ avoiding future detection rather than materially changing/revealing the conduct; (c) launching a program that requires deception to avoid significant risk of aggressive bid-shading;[162] and (d) false and misleading statements in communication documents. Google's purported "disclosures" about RPO did not constitute Transparent Disclosures.

**F.      The Wiggins Report Opinions Regarding Facebook Network Bidding Agreement are Incorrect.**

134.    The Wiggins Report responds to claims the Andrien Report regarding the Facebook Network Bidding Agreement ("NBA") in stating:

██████████████████████████████████████████████
██████████████████████████████████████████████
██████████████████████████████████████████████
██████████████████████████████████████████████
██████████████████████████████████████

135.    I opine on the logic of this statement as it pertains to Auction Theory, and not on the data itself or other details of the NBA. ████████████████████████████████ ████████████████████████████████████████████ This logic is flawed.

136.    A participant in an auction can indeed benefit from information while not winning any transactions. This is explained by the concept of a "lemon"[163] -- an uninformed buyer might find an impression (or used car) to be valuable, simply because some impressions (or used cars) are valuable, and it has no further information to distinguish this impression (or used car) from an average or a below average impression (or used car).

---

[162] I justify this point in detail in Section XI. The primary motivation for this claim is academic work of Devanur, Peres, and Sivan (2015) establishing in a model representative of RPO (but not perfectly representative) that an optimal buyer would bid-shade so aggressively in response to dynamic pricing that the seller receives *zero* revenue in equilibrium. *See* Devanur, Nikhil R., Yuval Peres, and Balasubramanian Sivan. "Perfect bayesian equilibria in repeated sales." Games and Economic Behavior 118 (2019): 570-588.

[163] Akerlof, George A. "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism." The Quarterly Journal of Economics, vol. 84, no. 3, 1970, pp. 488–500.

137. Further data on that impression (or a used car inspection) might reveal that the impression is less valuable (or a lemon), and the buyer might choose not to purchase the impression. Such a buyer benefits from the information received, even though it did not win any impressions (or used cars), because the information prevented it from purchasing a lemon.

**G.    Google's deceptive Display Advertising RTB Ecosystem could influence any auction.**

138. There are two manners by which the Deceptive Conduct affecting Google's Display Advertising RTB Ecosystem could influence any auction.

139. First, as previously described, there are some participants that would not even be in Google's Display Advertising RTB Ecosystem but for Google's deceptive description of AdX as a second-price auction,[164] or GDN as a tool that optimizes on behalf of its advertisers.[165] This conclusion is supported in the Milgrom Report, which states:

> Google recognized the advantages of bidder-truthful auctions, explaining them as follows: 'It's faster, less costly, and more fair to the less sophisticated advertisers to structure the auction in favor of true value.' *The lower transaction costs associated with bidding in a bidder-truthful auction encourage advertisers to participate on Google's platform,* which increases thickness, tending to improve the efficiency of its allocations and increase the prices paid to publishers.[166] (*emphasis added*)

140. Therefore, even if one cannot connect concrete changes in some participants' behavior to concrete Deceptive Conducts of Google, some bids and impressions would not be in Google's Display Advertising RTB Ecosystem at all but for Google's Deceptive Conducts.

141. Second, based on Auction Theory, participants generally change their behavior in a deceptive Display Advertising RTB Ecosystem, and these changes cannot always be tracked to a

---

[164] GOOG-DOJ-29803801 at -04. ("The AdX Auction model is 2nd price, as described in the Help Center. AdX runs a second price auction where the winner is the highest bid and the price is larger of the 2nd bid and the floor price. In other words, the transaction price equals the price to beat to win the auction. This price is independent of the winner's bids.")

[165] *See* Google, "About automated bidding." October 9, 2018. Available at https://web.archive.org/web/20181009104917/https://support.google.com/google-ads/answer/2979071?hl=en ("Automated bidding takes the heavy lifting and guesswork out of setting bids to meet your performance goals.")

[166] Expert Report of P. Milgrom, ¶65.

particular deceptive act. For example, a participant may understand that Google is deceptive and therefore not trust Google's text descriptions, and purported disclosures, yet also not fully understand the specifics of Google's auction mechanisms (for example, the code or algorithms), resulting in suboptimal behavior.

█████████████████████████████████████████████████████████████████████████████████
███████████████████████████████████████████████████████████████████████████ ██

Such behavior would not be optimal either in accordance with Google's text description of AdX as a second-price auction (advertisers should not change their bids based on the reserve in a second-price auction), or the operation of Google's actual operation of RPO (advertisers should aggressively lower bids due to RPO – raising bids is suboptimal for the immediate auction and causes higher reserves in subsequent auctions).

█████████████████████████████████████████████████████████████████████████████████

████████████████████████████████████████████████████████████ ████
█████████████████████████████████████████████████████████████████████████████████
█████████████████████████████████████████████████████████████████████████████████
████████████████████████████████████████████

144.  Even Google was concerned that changes to one auction would impact participant behavior in auctions "across the board." [169] That is, once participants stop trusting Google's text descriptions and start reacting to changes, these reactions would affect "all slots" and "across the whole exchange" rather than "just on the optimized slot."[170]

---

[169] GOOG-DOJ-15588979 at -80 ("Cross-publisher effect: once a buyer experiences the 'first-price' effect, they might assume it is occurring across the board, and then react to that not just on the optimized slot but on all slots. This could have the effect of driving down bids across the whole exchange.") This demonstrates a concern that bids will go down even on auctions not impacted by RPO.

[170] GOOG-DOJ-15588979 at -80 ("Cross-publisher effect: once a buyer experiences the 'first-price' effect, they might assume it is occurring across the board, and then react to that not just on the optimized slot but on all slots. This could have the effect of driving down bids across the whole exchange.") This demonstrates a concern that bids will go down even on auctions not impacted by RPO.

145.  In conclusion, in addition to the ample evidence of direct changes in behavior that result from Google's Deceptive Conduct (such as, bidding one's true value when it is suboptimal to do so), it is my opinion, based upon Auction Theory, that every auction was also indirectly impacted by Google's generally deceptive Display Advertising RTB Ecosystem. As stated above, some participants might not be in the Google Display Advertising RTB Ecosystem at all were it not for Google's Deceptive Conducts.[171] And also stated above, some participants will change their behavior in response to a generally deceptive Display Advertising RTB Ecosystem, and such changes may not be directly traceable to any particular Deceptive Conduct.

## V.    APPLYING FIRST PRINCIPLES OF AUCTION THEORY, OPINIONS OF GOOGLE'S EXPERTS REGARDING THE BEHAVIOR OF AUCTION PARTICIPANTS ARE INCORRECT

### A.    Google's Experts' Opinions are Incorrect as a Matter of Auction Theory.

146.  Google's expert reports propose that Google's Deceptive Conduct should be evaluated exclusively by its impact on Sophisticated and Fully Informed Participants.[172]  Instead, applying first principles of Auction Theory, it is my opinion that Google's Deceptive Conduct should be evaluated predominantly by its impact on Default Participants. Professor Milgrom and Professor Wiggins' claims that rely on this erroneous methodology are therefore invalid.

147.  In accordance with Auction Theory, my Opening Report observes that the impact of Google's Deceptive Conduct invariably depends on how publishers, advertisers, and rival products and intermediaries behave in Google's Display Advertising RTB Ecosystem. Google's experts agree with this point.[173] However, my opinion is that Google's experts improperly analyze participants' behavior.

---

[171] Moreover, this argument extends to any action a participant would take only as a result of joining Google's ad auction Display Advertising RTB Ecosystem. For example, if engaging with Google's ad auction products (GDN, AdX, DFP) lowers the barrier to other adtech, this argument would imply that participants may not have engaged with other adtech but for Google's misrepresentation of its ad auction Display Advertising RTB Ecosystem as simple when it is not. I am not offering an opinion on whether engaging with Google's ad auction products lowers the barrier to other adtech.

[172]  *See, e.g.*, Expert Report of S. Wiggins, ¶19 ("My analysis is grounded in the extensive evidence … regarding how advertisers, publishers, and their intermediaries make decisions primarily by monitoring return metrics, performing tests, and learning and adapting, rather than by monitoring public announcements regarding optimization features.").

[173] *See* Expert Report of P. Milgrom, ¶25 ("It is my opinion that accounting for advertiser and publisher incentives to respond to auction programs is necessary to evaluate correctly the economic effects of these programs.").

148. My Opening Report discusses the concept of a Default Participant. My Opening Report gives an example of a Default Advertiser as one who trusts Google when it says GDN "set[s] bids to meet your performance goals" for that advertiser.[174,175] This concept extends to a Default Intermediary acting on behalf of an advertiser. I give an example of a Default Publisher as one who trusts Google when Google says that Value CPMs are "an amount you specify to help Google Ad Manager estimate the value of campaigns,"[176] and therefore does not optimize these parameters to for pricing purposes.[177]

149. Repeating the definition from Section II., a Default Participant sets and acts upon strategies (behaves) based on Google's communications to them about the operation of Google's Display Advertising RTB Ecosystem.

150. I categorize these participants as Default Participants to reflect their behavior of "trusting" Google communications and acting in response thereto.

151. My Opening Report discusses the concept of a Sophisticated Participant. My Opening Report gives an example of a Sophisticated Advertiser as one who strategically optimizes information shared with their Ad Buying Tool.[178] My Opening Report gives an example showing a Sophisticated Publisher as one who recognizes that Value CPMs are parameters used to optimize prices, and therefore treats Value CPMs as a price-setting tool.[179] [180]

---

[174] *See* Google, "About automated bidding." October 9, 2018. Available at https://web.archive.org/web/20181009104917/https:/support.google.com/google-ads/answer/2979071?hl=en ("Automated bidding takes the heavy lifting and guesswork out of setting bids to meet your performance goals.")

[175] *See* Expert Report of M. Weinberg, footnote 114 ("On one end, a 'typical' advertiser may trust their ad buying tool to optimize on their behalf and input correct information whenever requested (i.e., a 'typical' advertiser would simply input their correct value for an impression when asked.)").

[176] *See* Google Ad Manager Help Center, "Value CPM." Available at https://web.archive.org/web/20221202071803/https://support.google.com/admanager/answer/177222?hl=en.

[177] *See* Expert Report of M. Weinberg, footnote 114 ("On one end, a 'typical' publisher may set parameters according to their ad server's suggested text without developing a detailed understanding of how those parameters are used.")

[178] *See* Expert Report of M. Weinberg, footnote 114 ("At the other end, a 'sophisticated' advertiser may fully digest all available documentation and aim to optimize inputs to their ad buying tool based on how these inputs are used, ignoring the ad buying tool's recommendations. They may even be able to optimize while accounting for the possibility of conduct that is never disclosed in publicly available documentation.").

[179] *See* Expert Report of M. Weinberg, footnote 114 ("At the other end, a 'sophisticated' publisher may fully digest all available documentation and aim to optimize parameters based on their use case, ignoring suggested text. They may even be able to optimize while accounting for the possibility of conduct that is never disclosed in publicly available documentation.").

[180] Professor Milgrom's report seems to object to my use of the term "sophisticated" because Professor Milgrom finds it to imply mathematical sophistication within Auction Theory. When I use the phrase 'sophisticated' throughout this Rebuttal Report and my Opening Report, I refer to and reiterate the definition stated in my Opening Report and in Section II.. In other words, applying first principles of Auction Theory, it is my opinion that it requires sophistication by a participant to understand that

HIGHLY CONFIDENTIAL

152.   Repeating the definition from Section II., a Sophisticated and Fully Informed Participant sets and acts upon strategies (behaves) based on the true properties of the Display Advertising RTB Ecosystem, even if those true properties are inconsistent with representations, public disclosures, and available data. As expressed throughout my Opening Report, it is my opinion that Google's Display Advertising RTB Ecosystem includes aspects that are concealed and aspects that are markedly different from Google's communication to participants.

153.   My Opening Report further discusses that the impact of Google's Deceptive Conduct is predominantly determined by its impact on Default Participants while acknowledging that Sophisticated Participants, who may be Fully or Well Informed about some conduct, also exist in the Google's Display Advertising RTB Ecosystem. Herein, as defined above, I refer to this framework as the Weinberg Framework.

154.   The Milgrom Report, the Wiggins Report, and the Baye Report analyze the impact of Google's Deceptive Conduct predominantly on Sophisticated and Fully Informed Participants. The Milgrom Report acknowledges that Sophisticated and Fully Informed Participants may spend inconsequential moments behaving suboptimally while learning.[181] All three reports further appear to claim, and the Wiggins Report claims,[182] that the impact of Google's Deceptive Conduct is *exclusively* determined by its impact on Sophisticated and Fully Informed Participants. Herein, as defined above, I refer to this framework as the Milgrom Framework.[183]

---

the real game (as "game" is understood in game theory and Auction Theory) does not match Google's communication. It is consistent for a Default Participant to be exceptional at mathematical optimization.

[181] *See e.g.* Expert Report of P. Milgrom, ¶56 ("Empirical evidence from online display advertising auctions suggests that agents learn to respond to auction design changes over time, and eventually come to adopt near-profit-maximizing strategies. This research suggests that strategic adaptation is not always immediate and that there is heterogeneity in the speed of learning, which implies that evidence about the impact of new programs gathered over short periods of experimentation must be evaluated with care: it may fail to capture eventual strategic adaptations and heterogeneity in effects over time and across agents.").

[182]   *See* Expert Report of S. Wiggins, ¶19 ("My analysis is grounded in the extensive evidence presented in Section II regarding how advertisers, publishers, and their intermediaries make decisions primarily by monitoring return metrics, performing tests, and learning and adapting, rather than by monitoring public announcements regarding optimization features. I conclude that none of the alleged Deceptive Conduct in this case generated incremental profits for Google, and thus that the appropriate DTPA civil penalty based on Mr. Andrien's framework is zero.").

[183] I call this the "Milgrom Framework" because the Milgrom Report provides the most detailed version of this framework. However, the Wiggins and Baye Reports conduct their analyses under this framework as well.

**B.    Methodology for Mathematical Modeling.**

155.  It is my opinion that experts in the field of Auction Theory try to balance: (a) accurately modeling real-world behavior with (b) ultimately doing mathematical analysis in a rigorous model.

156.  It is my opinion that sound models are such that the insights derived from mathematical analysis are relevant in practice. As it applies to Auction Theory, it is my opinion that a sound mathematical model would accurately evaluate the impact of Google's Deceptive Conduct.

157.  It is my opinion that one cannot "prove" one model is better than another using mathematics alone, and two distinct models sometimes provide complementary insights to the same setting. When two mathematical models propose contradictory conclusions, there are commonly accepted methodologies for picking a preferred model. Some of those methodologies, and my opinions with respect to their application to the competing frameworks here, are set forth below:

      **i.**   Which model best matches available evidence?

      Applying first principles of Auction Theory, it is my opinion that DRSv2's observed revenue lift is consistent only with the Weinberg Framework and not the Milgrom Framework.

      **ii.**  Which model best matches what "boots on the ground" claim?

      Applying first principles of Auction Theory, it is my opinion that Google's internal communications support the Weinberg Framework over the Milgrom Framework.

      **iii.**  Which model best matches *inferred* beliefs, based on participants actions?

      Applying first principles of Auction Theory, it is my opinion that the fact that Google launched products with high impact (as determined under the Weinberg Framework) but little or no impact (as determined under the Milgrom Framework), further support the Weinberg Framework over the Milgrom Framework.

      **iv.**  Which model "makes the most sense" from first principles?

      Applying first principles of Auction Theory, it is my opinion that The Weinberg Framework is supported by evidence showing Google's success in deceiving its participants and therefore "makes more sense" than the Milgrom Framework.

> **v.** Which model is most consistent with insights learned in related domains?
>
> Applying first principles of Auction Theory, it is my opinion that the Weinberg Framework is consistent with two schools of literature that both have similar elements to ad auctions: (a) domains where participants do not fully understand the game they are playing, and (b) "repeated games."[184]

### C.    Overview of Opinions regarding Auction Participant Behavior.

158.  The Milgrom Report claims that the Weinberg Framework (a) is "unreliable" and "fall[s] short of ordinary professional standards"[185] and (b) "offers neither evidence nor logic to justify [my] decidedly non-standard approach." [186] I disagree. My Opening Report supports a standard approach grounded in Auction Theory.  The summary of my key points are as follows.

159.   Applying first principles of Auction Theory, it is my opinion that evidence included in both the Weinberg Opening Report and the Milgrom Report refutes the Milgrom Framework. Specifically, both reports state the following two postulates: (a) if advertisers were Sophisticated and Fully Informed, DRSv2 would have no impact as compared to no DRS,[187] and (b) DRSv2 improved Google's revenue. [188] This argument alone refutes the Milgrom Framework.[189]

---

[184] "Repeated games" are discussed at length below.

[185] Expert Report of P. Milgrom, ¶28.

[186] Expert Report of P. Milgrom, ¶28.

[187] *See* Expert Report of P. Milgrom, ¶446 ("If buyers and publishers set bids and floors to maximize their payoffs after the introduction of DRS v2, then buyer surplus and publisher revenues are the same as in the absence of DRS."); Expert Report of M. Weinberg, ¶226.a ("If all advertisers responded optimally to DRSv2, no advertiser would bid in the dynamic region, and therefore DRSv2 would be equivalent to no DRS.").

[188] ███████████████████████████████████████████████████████████████████

[189] I also observe that these two postulates are clearly stated in nearly back-to-back paragraphs of Professor Milgrom's report. *See* Expert Report of P. Milgrom, ¶446 and ¶448.

160. Additional evidence included in my Opening Report supports the Weinberg Framework. Specifically:

   i. Certain Google programs serve little or no purpose with Sophisticated and Fully Informed Participants, yet Google developed and launched them and these programs indeed had notable impact.

   ii. Internal Google communications repeatedly discuss manners in which participants are not Sophisticated and Fully Informed. [190] Moreover, testimony and communications from Google employees repeatedly demonstrate a focus on Default Participants when dissecting impact.

161. Applying first principles of Auction Theory, it is my opinion that Google's Deceptive Conducts prevent participants from acting as Sophisticated and Fully Informed Participants. In particular, Google's Deceptive Conducts: (a) make the Default versus Sophisticated and Fully Informed distinction meaningful in the first place by inconsistent text descriptions pertaining to the rules of operation within the Google Display Advertising RTB Ecosystem, and (b) create a very high technical bar to overcome Google's deceptive efforts to conceal the differences.

162. Finally, contrary to the claim in Milgrom Report's that it is "decidedly non-standard" to consider anything except equilibrium behavior (i.e., Sophisticated and Fully Informed Participants), applying first principles of Auction Theory, it is my opinion that it is standard to consider non-equilibrium behavior. [191] It is my opinion that contrary to the claims in the

---

[190] *See, e.g.*, GOOG-AT-MDL-001873044 at -44 ("Setting optimal floor prices is challenging and requires a lot of time and effort. Many publishers are unable to dedicate sufficient resources to such a complex problem, leading to suboptimal floors that result in missed revenue opportunities."); *see also* GOOG-AT-MDL-002316501 at -06 ("Many advertisers (in particular smaller ones) behave suboptimally, which makes the problem of learning their true objective functions more difficult"); GOOG-TEX-00831373 at -78 ("███████████████████████████████████ ███████████ .

[191] This is true across multiple domains, and a perfect example to highlight is school choice. In comparison to the ad auctions domain: (i) the stakes are comparably high (the outcome determines where children will attend school), (ii) the ecosystem is significantly simpler (parents participate in an algorithm that can be described in a few sentences, and have a dominant strategy which is optimal no matter what other parents do), (iii) the surrounding communication is significantly more transparent (school districts spend significant effort explaining the few-line algorithm to parents, and hold numerous information sessions), although (iv) the participants are less experienced (representative parents are less experienced with matching algorithms than a representative advertiser is with auctions). The foregoing claims (ii) and (iii) strongly suggest that parents should better understand school choice than advertisers understand Google's Display Advertising RTB Ecosystem, while Section (i) is neutral and (iv) limits the strength of suggestion. And yet, even here there is strong evidence of non-Sophisticated and Fully Informed behavior, and an entire research community both studies the impact of this non-equilibrium behavior and actively investigates approaches to help parents better respond. Therefore, none of the above evidence supporting Default behavior should come as a surprise in the significantly more complex ad auctions domain, especially due to Google's Deceptive Conduct.

Milgrom Report, it is "decidedly non-standard" to dismiss non-equilibrium analysis as unreliable when faced with overwhelming evidence of non-equilibrium behavior.

163. The Milgrom Report contests many of my opening claims solely on the basis of contesting the Weinberg Framework. Demonstrating the applicability of the Weinberg Framework as I do below obviates the need for any further rebuttals to these arguments in the Milgrom Report.

### D.    The Weinberg Framework.

164. My Opening Report proposes that Google's Deceptive Conduct should be evaluated predominantly by its impact on Default Participants. I further define such participants below.

165. Applying the definition of a Default Participant to Advertisers and Ad Agencies, a Default Advertiser/Default Agency:

  i.    Trusts their Ad Buying Tool to optimize on their behalf, especially when the Ad Buying Tool explicitly claims to do so.[192]

  ii.   May track performance metrics of their Ad Buying Tool. Both the Milgrom Report and the Wiggins Report describe numerous meaningful metrics that advertisers can use to evaluate the performance of their Ad Buying Tool.[193] It is consistent with the Weinberg Framework for advertisers to evaluate their Ad Buying Tool.

  iii.  May use multiple Ad Buying Tools and may reallocate budget across them depending on performance metrics. Both the Milgrom Report and the Wiggins Report cite evidence that some advertisers and ad agencies indeed behave this

---

[192] *See* Google Ads Help, "About automated bidding," available at https://web.archive.org/web/20181009104917/https://support.google.com/google-ads/answer/2979071?hl=en ("Automated bidding takes the heavy lifting and guesswork out of setting bids to meet your performance goals. Each type of automated bid strategy is designed to help you achieve a specific goal for your business.")

[193] Expert Report of S. Wiggins, ¶47 ("Advertisers can focus on performance in part because the ad buying tools provide them with ready, salient, and valuable metrics by which they can measure the effectiveness of ad campaigns. These metrics include return on ad spend ('ROAS') or return on investment ('ROI'), click-through rates ('CTR'), cost per click ('CPC'), and cost per action ('CPA'.) For ease of exposition, I refer to these various measures as 'return metrics.' All of these measures relate directly to the advertiser's ultimate advertising objective, which is to increase returns on ad spend. There is strong evidence that advertisers can and do use these return metrics to assess the relative effectiveness of various strategies"); Expert Report of P. Milgrom, ¶32.a ("Advertisers leverage key performance indicators to guide their campaign strategies on buy-side tools and bid effectively. Rather than calculating bids themselves, advertisers delegate many of the details of bid optimization to specialized buy-side tools or agencies, while optimizing their campaign parameters to achieve higher click-through rates, conversion rates, or return on ad spend.").

way.[194] Nothing about the Weinberg Framework precludes advertisers who use multiple Ad Buying Tools and who reallocate budget from lower-performing to higher-performing tools.

    iv.   Is incentivized to optimize their returns. The Weinberg Framework agrees with the Milgrom Report and the Wiggins Report that advertisers possess strong incentives to make the most of their advertising budget. [195]

    v.   Trusts their Ad Buying Tool to optimize on their behalf. When Ad Buying Tools ask for the advertisers' budget, the advertiser reports its true budget. When Ad Buying Tools asks for the advertisers' value per conversion, the advertisers report their true value per conversion. Default Advertisers have a good understanding of "advertiser-facing" objectives, share these with their Ad Buying Tool, and trust the tool to optimize bids in order to achieve these objectives.

166.   Processing the definitions outlined in Section II. the distinction between a Sophisticated and Fully Informed Advertiser and a Default Advertiser is that a Sophisticated and Fully Informed Advertiser might misrepresent its value per conversion to its Ad Buying Tool to determine whether gaming its own Ad Buying Tool improves metrics.[196]

167.   Applying the definition of a Default Participant to a Default Publisher:

    i.   Trusts its Ad Server to describe the Ad Server's technology and does not do a deep technical dive into aspects that do not require their input. For example, a Default Publisher using DFP[197] would trust Google's description of Value CPMs as "an amount you specify to help Google Ad Manager estimate the value of campaigns."

---

[194] Expert report of S. Wiggins, ¶54 ("When advertisers multi-home with different ad buying tools, agencies can and do provide comparative information about performance and recommendations about how to reallocate budgets, which facilitates competition across ad buying tools."); Expert Report of P. Milgrom, ¶78 ("Self-competition can occur as a result of advertiser multi-homing, in which an advertiser uses multiple DSPs to submit bids for an impression, or DSP multi-homing, in which a DSP submits bids into multiple exchanges on behalf of a single advertiser.").

[195] Expert Report of P. Milgrom, ¶31 ("For many publishers and advertisers, there are vast sums of money at stake, and online display advertising makes up a significant fraction of their marketing revenue or spend."); Expert Report of S. Wiggins, ¶45 ("[Advertisers] continuously learn what strategies work best to maximize return on ad spend and adapt to implement those strategies.").

[196] And in particular, the elements above which are fully consistent with the Weinberg Framework do not distinguish Default from Sophisticated and Fully Informed Advertisers.

[197] DFP stands for DoubleClick for Publishers, Google's ad server. *See* Expert Report of M. Weinberg, ¶68.

ii.   Applying the definition of a Default Participant, a Default Publisher would see Google's description of Value CPMs as "the amount entered in the "Value CPM" field serves two purposes: (a) it's used in revenue calculations for impressions served, and (b) when a value CPM is defined for remnant line items, the Value CPM is used for competition in Dynamic Allocation and First Look instead of the "Rate' value" 198 and set all Value CPMs according to the formula Google provides immediately following. A Default Publisher would not dive into the mechanics of Dynamic Allocation, 199 determine that Value CPMs are really price floors for AdX, and instead decide to set Value CPMs as if they are price floors.

iii.   May have a dedicated pricing team that tracks performance metrics to optimize pricing. The team may have an understanding of price optimization ranging from basic to advanced. Within the Weinberg Framework, Default Publishers could have dedicated pricing teams and that may have optimization abilities. But a Default Publisher using DFP would optimize parameters such as price floors for pricing purposes,200 and would not consider Value CPMs as part of this optimization.

iv.   Is strongly incentivized to optimize their returns. The Weinberg Framework, the Milgrom Report, and the Wiggins Report contemplate that publishers possess strong incentives to optimize profits.201

v.   Trusts their Ad Server to describe its own tech. When DFP provides an explicit formula to set Value CPMs,202 a Default Publisher sets Value CPMs as such. When DFP describes price floors as "a value below which [DFP] can guarantee a

_____

198 *See* Google Ad Manager Help Center, "Value CPM." Available at https://web.archive.org/web/20221202071803/https://support.google.com/admanager/answer/177222?hl=en.

199 *See* DoubleClick by Google, "Maximize Yield." August 26, 2011, available at https://web.archive.org/web/20110826055821/http://www.google.com/doubleclick/publishers/maximize_yield.html ("Dynamic Allocation [] Capture every opportunity from unsold and non-guaranteed impressions. With dynamic allocation, our auction can immediately bid for any unsold or non-guaranteed impression, according to your specified minimums and restrictions, to maximize your revenue."). Learning the precise role played by Value CPMs requires a *significantly* deeper dive.

200 Moreover, a Default Publisher would also not inflate their desired price floors by 20% to account for Google's ability to lower their price floor by up to 20% under tDRS, because this ability was never transparently communicated.

201 *See* Expert Report of S. Wiggins, ¶83 ("[P]ublishers' focus on the revenue generated by impressions") and Expert Report of P. Milgrom, ¶30 ("[S]ome […] publishers even employ teams of engineers, economists, and marketing experts devoted to maximizing returns by finding all possible improvements in advertising yields.").

202 *See* Google Ad Manager Help Center, "Value CPM." Available at https://web.archive.org/web/20221202071803/https://support.google.com/admanager/answer/177222?hl=en.

buyer's bid will be filtered"203 a Default Publisher sets price floors as such. Default Publishers have an understanding of price optimization (perhaps basic, perhaps advanced), and engage as such with parameters highlighted by their Ad Server for this purpose.

168. Processing the definitions outlined in Section II., the distinction between a Sophisticated and Fully Informed Publisher and a Default Publisher is that a Sophisticated and Fully Informed Publisher understands the tech underlying their Ad Server and how each parameter is really used on the back end. A Sophisticated and Fully Informed Publisher might therefore use Value CPMs as a price optimization tool or increase their AdX price floor beyond the minimum price they would accept to account for tDRS.[204] [205]

169. Applying the definition of a Default Participant to Ad Buying Tools, a Default Ad Buying tool:

    i. Trusts an Ad Exchange claiming to run a second-price auction. In particular, if an Ad Exchange claims to run a second-price auction, a Default Ad Buying Tool would at minimum believe that Ad Exchange to be running a truthful auction. A Default Ad Buying Tool would therefore not optimize its bid into an Ad Exchange claiming to run a second-price auction, and would spend its energy addressing other engineering challenges.[206]

    ii. May track data received from Ad Exchanges and eventually detect anomalies. But a Default Ad Buying Tool would trust any private communication after raising

---

[203] Google Ad Manager Help, "Unified Pricing Rules." Available at https://web.archive.org/web/20240604022405/https:/support.google.com/admanager/answer/9298008?hl=en.

[204] The latter would be particularly impressive, given Google's misleading communications. *See* GOOG-TEX-00858434 at -40 ("Before or after the July change, we still do NOT pay publishers below publisher's floor […]").. The "disclosures" cited in the Milgrom Report also do not provide meaningful information for a publisher to recognize this feature of tDRS. *See* Section IV.

[205] And in particular, the elements above which are fully consistent with the Weinberg Framework do not distinguish Default from Sophisticated and Fully Informed Publishers.

[206] Such as budget management (*see* Expert Report of P. Milgrom, ¶15.d ("Project Elmo […] ensur[ed] that [advertiser] budgets were not depleted too quickly as a result of multi-calling by publishers and bid duplication by exchanges.")), multicalling (*see* Expert Report of P. Milgrom, ¶15.b ("Project Bell benefited Google Ads advertisers by protecting them from a publisher tactic called multi-calling, which would otherwise reduce their advertiser surplus.")), and bid optimization into exchanges *known* not to be truthful (*see* Expert Report of P. Milgrom, ¶15.c ("Projects Poirot and Marple benefited advertisers using DV360 and Google Ads, respectively, by optimizing their bids to prevent advertisers from overpaying when auctions were not second-price auctions.")).

these anomalies with the Ad Exchange as accurate.[207] [208] It is consistent with the Weinberg Framework for Ad Buying Tools to track data and notice anomalies. But a Default Ad Buying Tool would not confidently act on anomalies that contradict claims made by an Ad Exchange whose communication they trust to be accurate, especially if that Ad Exchange adjusts its behavior so that the anomalies are no longer detected.

iii. May have bid optimization tools for use on first-price Ad Exchanges, and consider testing those tools on a second-price Ad Exchanges. Nothing about the Weinberg Framework precludes Ad Buying Tools testing bid optimization tools on a claimed second-price auction. But tools of a Default Ad Buying Tool would not overcome proactive deceptive efforts by an Ad Exchange with Google's capabilities.[209]

iv. Is strongly incentivized to optimize their profits. This means both that Ad Buying Tools are incentivized to optimize direct profits via whatever contracts they've set up with their clients, and to optimize returns on behalf of their clients. The Weinberg Framework agrees with the Milgrom Report and Wiggins Report that Ad Buying Tools possess strong incentives to optimize profits from themselves and their clients.[210]

---

[207] ████████████████████████████████████████████████████

[208] Moreover, some Deceptive Conduct may not even produce detectable anomalies. *See* Deposition of Korula, Nitish, April 19, 2024, 316:18-317:25 ("Q. Well, is -- is -- is DRS either in version 1 -- I guess DRS version 2, would a buyer ever be able to observe if recollection has happened? A. I don't know that a buyer would be able to observe that it's happened on this query versus another query, but from the buyer's point of view they might be agnostic to that, right. They paid, you know, five dollars on one query and ten dollars on another query. If Google took a, you know, 19 percent revenue share on the ten dollar query and a 21 percent revenue share on the five dollar query, the publisher would get paid some amount so that's -- you know, the buyer doesn't necessarily observe how much went to the Google and how much went to the publisher on each individual query. Q. Okay. So, and then that -- and I think that's my question. I'm not ask if the buyer cares about the revenue share that Google takes. I'm asking if it's possible for the buyer to determine whether Google used this recollection mechanism. A. I don't believe it was possible for the buyer to observe that on any particular query. Ultimately they bid something. Google takes some share. The rest goes to the publisher, what they pay, what the buyer pays.").

[209] GOOG-017664768 is an email chain involving Google researchers (who are among the top auctions researchers in the world) and engineers discussing sophisticated ideas to "minimize [] correlation" between advertisers' bids and their RPO floors.

[210] *See* Expert Report of S. Wiggins, ¶63 ("[C]ompetitive pressure on ad buying tools, along with many advertisers' simultaneous use of multiple ad buying tools, incentivizes ad buying tools to continually learn and optimize their bidding strategies. Because many advertisers simultaneously use multiple ad buying tools and because those advertisers and advertising agencies closely monitor and compare returns of ad buying tools , if an ad buying tool is not bidding effectively, it will likely be out-competed by an alternative that offers advertisers lower costs and higher returns. In this way, advertisers' (and their ad agencies') focus on performance creates competitive pressure on ad buying tools to optimize their strategies. These competitive pressures create strong incentives for ad buying tools to keep secret any innovative strategies or optimizations that they develop to help

v.   Would bid their value into an Ad Exchange claiming to be a second-price auction, and certainly into an Ad Exchange with Google's expertise that both takes active steps to avoid detection and that deceives in private communications when anomalies are raised.

170.  Processing the definitions outlined in Section II. the distinction between a Sophisticated and Fully Informed Ad Buying Tool and a Default Ad Buying Tool is that a Sophisticated and Fully Informed Ad Buying Tool would need a deep understanding of Auction Theory to (a) detect anomalies over Google's active attempts to conceal Deceptive Conduct, and also (b) confidently act on anomalies that contradict direct communication from an Ad Exchange with Google's capabilities. [211]

**E.    The Milgrom Framework is Not Supported by First Principles of Auction Theory.**

171.  My Opening Report and the Milgrom Report agree on the following:

i.   Both reports state: if all advertisers are Sophisticated and Fully Informed, then DRSv2 produces exactly the same outcomes as no DRS. [212]

ii.  Both reports cite internal Google reports stating DRSv2 provided revenue lift for publishers over no DRS. [213]

172.  Applying first principles of Auction Theory, it is my opinion that both reports contain sufficient evidence to conclude that not all advertisers are Sophisticated and Fully Informed, thereby refuting the Milgrom Framework and the basis of the Milgrom Report's analysis.

---

advertisers maximize their returns.");Expert Report of P. Milgrom, ¶30 ("Many advertisers contract with specialized intermediaries (such as advertising agencies) to perform similar optimizations for them, and some advertisers and publishers even employ teams of engineers, economists, and marketing experts devoted to maximizing returns by finding all possible improvements in advertising yields.").

[211] And in particular, the elements above which are fully consistent with the Weinberg Framework do not distinguish Default from Sophisticated and Fully Informed Publishers.

[212] Expert Report of P. Milgrom, ¶446 ("If buyers and publishers set bids and floors to maximize their payoffs after the introduction of DRS v2, then buyer surplus and publisher revenues are the same as in the absence of DRS."); Expert Report of M. Weinberg, ¶226.a ("If all advertisers responded optimally to DRSv2, no advertiser would bid in the dynamic region, and therefore DRSv2 would be equivalent to no DRS.").

[213]

173. Both reports state that *every* Sophisticated and Fully Informed Advertiser provides no additional revenue under DRSv2 compared to no DRS. Therefore, even an approximate version of the Milgrom Framework is not supported.

**F.    Google Invested Significant Resources into Developing Programs that Would Serve Little or No Purpose to Sophisticated and Fully Informed Participants.**

174. It is my opinion that Google developed several programs whose impact would have been minimal or non-existent with Sophisticated and Fully Informed Participants.

175. Applying first principles of Auction Theory, this reflects that Google *does not* believe its programs should be evaluated based on their impact in a Display Advertising RTB Ecosystem of Sophisticated and Fully InformedAdvertisers, as otherwise they would have invested in an entirely moot program.[214] The  fact that Google developed these programs reflects Google's belief that the impact of its programs will *not* be determined by Sophisticated and Fully Informed Participants, and it is my opinion that this therefore supports the Weinberg Framework over the Milgrom Framework.

176. In my Opening Report, I opined that tDRS is equivalent to allowing Google to lower the publisher's reserve by up to 20%.[215] The Milgrom Report does not dispute this opinion.[216] Google's development of tDRS shows that Google does not believe publishers are Sophisticated and Fully Informed and, specifically, that Google did not think publishers were already setting optimal reserves.[217]

---

[214] I acknowledge that Professor Milgrom's report claims that the DRS roadmap always included DRSv1, DRSv2, and tDRS, and therefore Google developed DRSv2 merely as a stepping stone towards tDRS. Taking this together with the Milgrom Framework would require one to believe that launching a program for two years that does absolutely nothing would provide valuable insight to launching tDRS.

[215] This is after accounting for debt, and assuming that all debt clears. *See* Expert Report of M. Weinberg, ¶223 ("The only distinction between tDRS and DRS is that tDRS gives AdX more flexibility over the effective reserve for its auction (under no DRS, it must be at least r/0.8, where r is the publisher's price floor,340 with tDRS, AdX can now set the effective reserve as low as r.).").

[216] The Milgrom Report does not explicitly state this claim, but the underlying logic to his Theorem 9 is similar. *See* Expert Report of P. Milgrom, ¶456.

[217] Another possible answer, that I explain in more detail in Section XII. is that the optimal reserve from Google's perspective (who gets zero revenue if the transaction is unsold through AdX) is lower than the optimal reserve from the publisher's perspective (who gets some revenue if the transaction is unsold through AdX.) Therefore, even if publishers set optimal reserves from their perspective, tDRS would be in Google's interest *but against the publisher's interest*. But there are only two possibilities here: (a) publishers are not setting optimal reserves, or (b) tDRS is counter to publishers' interests – it is logically impossible for tDRS to be in publishers' interest when they are already setting optimal reserves.

177. RPO attempts to optimize reserves on publishers' behalf.[218] Google's development of RPO shows that Google did not believe publishers are Sophisticated and Fully Informed – again, that Google did not think publishers were already setting optimal reserves.

178. RPO applies in settings where Google believes an advertiser's value for past impressions is highly predictive of its value for similar future impressions and sets up a complex game between Google and its advertisers.[219,220,221] Academic research establishes that a variant of this complex game unravels – concern about future prices causes a Sophisticated and Fully Informed bidder to shade their bids so hyper-aggressively that a Sophisticated and Fully Informed seller does not extract *any* revenue.[222] This shows that Google *does not* believe its programs should be evaluated based on their impact in an Display Advertising RTB Ecosystem of Sophisticated and Fully Informed Advertisers, as otherwise they have invested in a program with significant risk of substantial revenue loss.

179. Applying first principles of Auction Theory, it is my opinion that beliefs inferred from Google's decision to develop programs with no, minimal, or negative impact with

---

[218] Because RPO can only raise a publisher's reserve, and the optimal reserve from Google's perspective is lower than from the publisher's perspective, the caveat for tDRS does not arise.

[219] GOOG-DOJ-13199910, at -920 ("Daily pipeline to compute pricing file based on 'yesterday' data), -925 ("Compute bid distributions for 'yesterday'[.] Find 'optimal' reserve prices[...]").

[220] The Milgrom Report claims that this game already existed without RPO. I agree that this game could have existed in some form without RPO, but it is my opinion that RPO exacerbated this game and made it widespread. I give a deeper response on this aspect in Section IV. but briefly acknowledge here that this point was challenged in The Milgrom Report.

[221] In particular, advertisers must be careful about submitting bids equal to their value, because RPO can then set future reserves equal to this value. Advertisers must even be careful about submitting bids close to their value, as any information revealed will cause RPO to set higher future reserves. RPO must then consider this potential extreme bid-shading when setting their own reserves, complicating both sides of the process.

[222] Multiple works consider a single-buyer, single-seller game that would exactly capture a single "flat" advertiser (whose value does not change day-to-day) and RPO. They all conclude that the seller achieves zero revenue in equilibrium with a Sophisticated and Fully Informed buyer. These models capture RPO in settings with a single competitive "flat" advertiser, but not with multiple competitive advertisers. *See* Devanur, Nikhil R., Yuval Peres, and Balasubramanian Sivan, "Perfect bayesian equilibria in repeated sales." Games and Economic Behavior 118 (2019): 570-588; Oliver D Hart and Jean Tirole, Contract renegotiation and coasian dynamics. The Review of Economic Studies, 55(4): 509–540, 1988; Klaus M Schmidt, Commitment through incomplete information in a simple repeated bargaining game. Journal of Economic Theory, 60(1):114–139,1993. Immorlica, Lucier, Pountourakis and Taggart (2017) study a multi-buyer non-auction interaction (where the seller posts a price each day and a random bidder exceeding the payment wins, rather than the highest bidder), and find an equilibrium that earns non-zero revenue, but less than a second-price auction with no reserve. Both lines of work leave open the problem of resolving the multi-buyer auction case, so academic research does not provide a perfect prediction of how Sophisticated and Fully Informed advertisers would respond to RPO. That being said, all academic research in the most relevant model concludes that RPO-style reserves with Sophisticated and Fully Informed Advertisers perform no better (or worse) than if there were no reserve at all. It is therefore my opinion that academic research *suggests a significant risk of* (but is not conclusive enough to outright *predict*) revenue loss when deploying RPO with Sophisticated and Fully Informed Advertisers. *See* Immorlica, Nicole, et al., "Repeated sales with multiple strategic buyers." Proceedings of the 2017 ACM Conference on Economics and Computation, 2017.

Sophisticated and Fully Informed Participants support the Weinberg Framework over the Milgrom Framework.

**G.      Google's Depositions and Internal Communications Show Google's Belief that its Participants are Default Participants.**

180.  Google's employees have stated that its participants are Default Participants.

181.  The following communications from Google employees show their belief that certain participants are not Sophisticated and Fully Informed:

   i.  "Keep in mind that the majority of bidders are quite primitive."[223]

   ii.  "Setting optimal floor prices is challenging and requires a lot of time and effort. Many publishers are unable to dedicate sufficient resources to such a complex problem, leading to suboptimal floors that result in missed revenue opportunities."[224]

   iii.  "Many advertisers (in particular smaller ones) behave suboptimally, which makes the problem of learning their true objective functions more difficult."[225]

182.  Some communications explicitly describe Google's Deceptive Conduct with Default Participants.

   i.  "an industry wide push [...] led to AdX [...] remov[ing] a 'last look' advantage Google had (essentially being able to see the Header Bidding bid before the 2nd Price auction)."226

---

[223] GOOG-AT-MDL-015283483 at -83.  Internal comment thread discussing the incentives induced by RPO. The commenter follows with, "[w]e're implicitly favouring the small handful that aren't if we introduce something new that they have to..." -- suggesting that the 'primitive' buyers should take first-order consideration in this discussion.

[224] GOOG-AT-MDL-001873044 at –44. This is from a launch announcement of RPO (whose purpose is to address this challenge that many publishers are unable to address themselves.)

[225] GOOG-AT-MDL-002316501 at –06. █████████████████████████████████████████████████████████████████████████████████████

[226] GOOG-DOJ-AT-00576380 at -81 (emphasis added). This quote describes DA under the Weinberg Framework where publishers do not boost -- it is inconsistent with the Milgrom Framework for publishers to send the header bid directly into AdX without boosting.

ii.  "Through Dynamic allocation, AdX has a real-time bid, whilst other SSPs/ exchanges operated on a historical average (value CPM)."[227]

183.    There are also internal Google communications that suggest a belief that certain participants are Sophisticated and Well Informed, such as, the following quote: "FYI that RPO is not escaping our buyers' attention. To the extent we can arm our gTech and Sales teams with real info about what's really going on, we are going to lose trust with our clients and hurt our relationships. These buyers are sophisticated and Google already has a target on our backs."[228]

## H.    Google's Deception Created Barriers for Sophisticated and Fully Informed Participants.

184.  Evidence that I have examined shows that Google's Deceptive Conduct leads to Default rather than Sophisticated and Fully Informed Participants. This contradicts Google's expert reports, specifically, Google's position that its participants are Sophisticated and Fully Informed.

185.  Google described AdX to its participants as "a second price auction where the winner is the highest bid and the price is larger of the 2 bid and the floor price. In other words, the transaction price equals the price to beat to win the auction."[229]  Google "disclosed" DRSv1 to its participants as follows: "[i]n some cases, the auction may close at a price lower than the reserve price applied, due to auction optimizations."[230] Google "disclosed" DRSv2 to its participants as follows: "[t]o optimize the auction, Google may choose to close an auction at a price  that would have otherwise been applied. In such cases, the winning buyer may pay a price below the reserve and therefore receive a discount on its bid. A buyer that has received discount(s) on its bid(s) may face higher reserve prices in subsequent transactions to offset such discount(s)."[231] Google disclosed RPO to its participants as follows: "optimized pricing to help

---

[227] GOOG-AT-MDL-004411012 at -15. This quote describes DA under the Weinberg Framework where publishers set Value CPMs exactly as suggested by Google's text and explicit formula – it is inconsistent with the Milgrom Framework for publishers to set Value CPMs as such, instead of as price-optimization tools.

[228] ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ *See* GOOG-AT-MDL-017393789 at -89 ("We've been able to replicate the results and have removed the effect observed. For external communication, I think we should say that this is due to a small % of traffic experiment, and that we are constantly trying out new things in the auction (do not mention the revenue share.)").

[229] GOOG-DOJ-29803801 at -04. ("The AdX Auction model is 2nd price, as described in the Help Center. AdX runs a second price auction where the winner is the highest bid and the price is larger of the 2nd bid and the floor price. In other words, the transaction price equals the price to beat to win the auction. This price is independent of the winner's bids.").

[230] GOOG-AT-MDL-C-000035251 at -51.

[231] GOOG-AT-MDL-C-000035252 at -52. I also repeat that this same "disclosure" contains the false statement "[r]egardless of whether any adjustments are made, the winning buyer will never be charged more than the bid it submits."

publishers set price floors in the Open Auction that more closely reflect the value of their inventory."[232]

186.  Applying first principles of Auction Theory, it is my opinion that a Default Advertiser operating on the basis of these descriptions would believe AdX to be a truthful auction and bid its true value into AdX. This is simply because none of the above "disclosures" contradict that "the transaction price equals the price to beat to win the auction."[233]

187.  Section IV. describes Google's steps to prevent Advertisers, Agencies, and Ad Buying Tools from learning the true auction format. These steps include Google (i) crafting false statements to its participants (in Google's internal communication messaging documents), and (ii) attempting to avoid detection by its participants through technical maneuvers.[234] ███████████ ████████████████████████████████████████████████████████████ ███████████████

188.  Google had taken one step towards transparency ██████████████ when describing that "flat bidders are more likely to face more aggressive pricing."[236] After receiving this response, ███████████████████████████████████████████████████████[237] However,

---

[232] GOOG-AT-MDL-C-000015606 at -11.

[233] And, moreover, Google still explicitly suggested that advertisers bid their true value. *See* GOOG-AT-MDL-001391101 at -06 ("Ensure you're always bidding the value of the auction to you.").

[234] For example, both the Milgrom Report and deposition testimony from a Google employee note the exceptional difficulty in detecting the DRSv2 debt mechanism. *See* Expert Report of P. Milgrom, footnote 884 ("Another source of complexity under the first two versions of DRS was that, to optimize bids, a buyer would need to track performance across many auctions (ones on which revenue shares were discounted and others for which debt were repaid), making experiments by that buyer on subsets of impressions more difficult."); *see also* Deposition of Korula, Nitish, April 19, 2024, 316:18-317:25. ("Q. Well, is -- is -- is DRS either in version 1 -- I guess DRS version 2, would a buyer ever be able to observe if recollection has happened? A. I don't know that a buyer would be able to observe that it's happened on this query versus another query, but from the buyer's point of view they might be agnostic to that, right. They paid, you know, five dollars on one query and ten dollars on another query. If Google took a, you know, 19 percent revenue share on the ten dollar query and a 21 percent revenue share on the five dollar query, the publisher would get paid some amount so that's -- you know, the buyer doesn't necessarily observe how much went to the Google and how much went to the publisher on each individual query. Q. Okay. So, and then that -- and I think that's my question. I'm not ask if the buyer cares about the revenue share that Google takes. I'm asking if it's possible for the buyer to determine whether Google used this recollection mechanism. A. I don't believe it was possible for the buyer to observe that on any particular query. Ultimately they bid something. Google takes some share. The rest goes to the publisher, what they pay, what the buyer pays.").

[235] ███████████████████████████████████████████████████████████ ███████████████████████████████████████

[236] GOOG-AT-MDL-004416785 at -86.

[237] ███████████████████████████████████████████████████████████

the same response also repeats false claims about DRSv2,[238] and there do not appear to be efforts by Google to share their RPO communication more broadly. Therefore, this is evidence of limited potentially Sophisticated and Well Informed Ad Buying Tools with respect to RPO, which is consistent with the Weinberg Framework.[239]

189. An internal Google email confirms only two inquiries regarding either DRS or RPO.[240] This supports my opinion that the vast majority of advertisers and Ad Buying Tools did not overcome Google's Deceptive Conduct and behaved in manner of a Default Participant.[241]

190. Google describes GDN's "autobidding" function as optimizing yield on behalf of advertisers.[242]  Operating only on the basis of this description, a Default Advertiser would believe GDN to perform best on behalf of the advertiser with accurate information, and report its true value per click/conversion/action (whatever information it uses to interact with GDN).

191. Google did not disclose Project Bernanke. Google's experts did not provide any evidence or instances of any advertiser detecting Project Bernanke.[243]  This suggests that advertisers were not aware that GDN was not optimizing on their behalf and would have therefore behaved in the Default manner.

192. Google described Value CPMs to publishers as "an amount you specify to help Google Ad Manager estimate the value of campaigns,"[244] price floors are described as "a value below which [DFP] can guarantee a buyer's bid will be filtered,"[245] Google described Dynamic

---

[238] *See* GOOG-TEX-00858434 at -37 ("Buyers are never charged more than their bid.").

[239] As the Weinberg Framework proposes that Google's Deceptive Conduct be evaluated *predominantly* by its impact on Default Participants.

[240] GOOG-AT-MDL-B-006338037 at -37 ("███████████████████████████████████████ ███████████████. Thus, I am reaching out to you to ask if you have received or aware of external inquiries specific to these 2 features [DRS or RPO] [...] I am currently not aware of any additional external enquiries on the subject.")

[241] Again, I note that this claim is *obvious* for DRSv2, as there is incontrovertible evidence of widespread bidding in the dynamic region.

[242] *See* Google, "About automated bidding." October 9, 2018. Available at https://web.archive.org/web/20181009104917/https:/support.google.com/google-ads/answer/2979071?hl=en ("Automated bidding takes the heavy lifting and guesswork out of setting bids to meet your performance goals.").

[243] Moreover, an advertiser using GDN's autobidding feature does not even know the CPM value computed by GDN on its behalf, and so such an advertiser could not even recognized that they are occasionally being charged their 'value' (which they don't know).

[244] *See* Google Ad Manager Help Center, "Value CPM." Available at https://web.archive.org/web/20221202071803/https:/support.google.com/admanager/answer/177222?hl=en

[245] Google Ad Manager Help, "Unified Pricing Rules." Available at https://web.archive.org/web/20240604022405/https:/support.google.com/admanager/answer/9298008?hl=en

Allocation as "captur[ing] every opportunity from unsold and non-guaranteed impressions. With dynamic allocation, our auction can immediately bid for any unsold or non-guaranteed impression, according to your specified minimums and restrictions, to maximize your revenue…"[246] Google "disclosed" RPO as "optimized pricing to help publishers set price floors in the Open Auction that more closely reflect the value of their inventory."[247] Google "disclosed" DRS as "to optimize the auction, Google may choose to close an auction at a price lower than the reserve price that would have otherwise been applied."[248] Google publicly and privately stated "we still do NOT pay publishers below publisher's floor."[249]

193.    Applying first principles of Auction Theory, it is my opinion that a Default Publisher operating only on the basis of the descriptions identified in the preceding paragraph would believe it optimal to set Value CPMs as described. A Default Publisher would further believe that they will never be paid less than their price floors.

194.    The Milgrom Report, Baye Report, and Wiggins Report do not contain any evidence that any publishers became aware that AdX sometimes paid less than their floors due to tDRS.

195.    My Opening Report and the Milgrom Report present evidence that some publishers learned that Value CPMs should also be used to optimize prices.[250,251] This evidence does not change my opinion that Google's Deceptive Conduct should be evaluated *predominantly* by its impact to Default Publishers.

196.    In summary, applying first principles of Auction Theory, it is my opinion that Google's Deceptive Conduct resulted in a very high technical bar for participants to clear in order to be Sophisticated and Fully Informed Participants, which supports the Weinberg Framework over the Milgrom Framework.

---

[246] *See* GOOG-AT-MDL-B-008550566 at -66.

[247] Google Ad Manager, "Smarter optimizations to support a healthier programmatic market." Available at https://blog.google/products/admanager/smarter-optimizations-to-suppor/.

[248] GOOG-AT-MDL-004416785 -87.

[249] GOOG-AT-MDL-B-007768543 at -49.

[250] *See* Expert Report of P. Milgrom, ¶376 (" ███████████████████████████ ██████████████████ "); Expert Report of M. Weinberg, footnote 221 ("some publishers use[s] default options while others were sophisticated and increased Value CPMs of header bids to boost AdX's reserve.").

[251] If there were evidence of *widespread* publishers using Value CPMs to optimize prices, this would be mitigating evidence towards the Weinberg Framework. Professor Milgrom's report does not cite evidence of such *widespread* behavior, and I am not aware of such evidence otherwise.

### I.    There is Nothing "Non-Standard" about Default Behavior.

197.  The assertion in the Milgrom's Report that non-equilibrium analysis is "decidedly non-standard" and "unreliable" is not supported.[252]

198.  It is my opinion that non-equilibrium analysis is well studied within Auction Theory, Economics, and Computer Science, including in comparably high-stakes settings to the ad auction domain.

> i.  One reason for non-equilibrium analysis is when participants do not fully understand the game they are playing. School Choice, where parents provide input to an algorithm that determines where their children go to school, is perhaps the most salient example. Although the Deferred Acceptance algorithm is truthful (it is in every parent's interest to rank programs from favorite to least favorite, no matter what other parents report), and it is easy for academics to understand this, parents in practice do not play their optimal strategy.[253] The issue is that parents do not understand the Deferred Acceptance algorithm, nor its truthfulness property, and a substantial field has exploded over the past several years attempting to address this.[254] There are clear similarities to the ad auctions domain, as participants clearly do not fully understand Google's Display Advertising RTB Ecosystem.[255]

---

[252] Expert Report of P. Milgrom, ¶25 ("It is my opinion that accounting for advertiser and publisher incentives to respond to auction programs is necessary to evaluate correctly the economic effects of these programs, and Plaintiffs' experts' analyses that fail to do so are unreliable."), ¶28 ("It is my opinion that Plaintiffs' experts' analyses that omit participants' incentives are unreliable, falling short of ordinary professional standards. When Professor Weinberg characterizes floor price optimizations by publishers as applying only to publishers who are "sophisticated" or "clever," he offers neither evidence nor logic to justify his decidedly non-standard approach.").

[253] *See* Kapor, Adam J., Christopher A. Neilson, and Seth D. Zimmerman. "Heterogeneous beliefs and school choice mechanisms." American Economic Review 110.5 (2020): 1274-1315; Arteaga, Felipe, et al. "Smart matching platforms and heterogeneous beliefs in centralized school choice." The Quarterly Journal of Economics 137.3 (2022): 1791-1848.

[254] *See* Li, Shengwu. "Obviously strategy-proof mechanisms." American Economic Review 107.11 (2017): 3257-3287; Ashlagi, Itai, and Yannai A. Gonczarowski. "Stable matching mechanisms are not obviously strategy-proof." Journal of Economic Theory 177 (2018): 405-425; De Haan, Monique, et al. "The performance of school assignment mechanisms in practice." Journal of Political Economy 131.2 (2023): 388-455; Pycia, Marek, and Peter Troyan. "A theory of simplicity in games and mechanism design." Econometrica 91.4 (2023): 1495-1526; Gonczarowski, Yannai A., Ori Heffetz, and Clayton Thomas. *Strategyproofness-exposing mechanism descriptions*. No. w31506. National Bureau of Economic Research, 2023.

[255] I again want to emphasize that the domains are not identical. In comparison to the ad auctions domain: (i) the stakes are comparably high (the outcome determines where children will attend school), (ii) the ecosystem is significantly simpler (parents participate in an algorithm that can be described in a few sentences, and have a dominant strategy which is optimal no matter what other parents do), (iii) the surrounding communication is significantly more transparent (school districts spend significant effort explaining the few-line algorithm to parents, and hold numerous information sessions), although (iv) the participants are less experienced (representative parents are less experienced with matching algorithms than a representative

ii. A second reason for non-equilibrium analysis is "repeated games." Equilibria in complex repeated games are often convoluted and require intense reasoning on behalf of participants. For example, my own work considers a non-equilibrium model for repeated single-item auctions.[256] Ad auctions have an aspect of repeated games to them, and this viewpoint is especially relevant when considering Deceptive Conduct like RPO (where one player's behavior today affects another player's behavior tomorrow).

199. It is my opinion that first principles of Auction Theory do not support the Milgrom Report's claim that equilibrium analysis is the *only* relevant analysis, especially when faced with overwhelming evidence that Google's participants are not behaving in equilibrium. Based on Auction Theory, it is my opinion that it is appropriate to perform non-equilibrium analysis in this case.

**J.    Rebuttal to the Milgrom Report and the Wiggins Report Critique of the Weinberg Framework.**

200. The Milgrom Report and the Wiggins Report state that the Weinberg Framework is "unreliable, falling short of ordinary professional standards, […] non-standard [in its] approach"[257] and "incorrect."[258]

201. The Milgrom Report alleges that some publishers "boosted" Value CPMs due to Dynamic Allocation, which is not behavior that would be consistent with a Default Participant.[259] My

---

advertiser is with auctions) -- (ii) and (iii) strongly suggest that parents should better understand school choice than advertisers understand Google's Display Advertising RTB Ecosystem, while (i) is neutral and (iv) limits the strength of suggestion.

[256] *See* Braverman, Jieming Mao, Jon Schneider, and Matt Weinberg. Selling to a no regret buyer. In Proceedings of the 2018 ACM Conference on Economics and Computation, Ithaca, NY, USA, June 18-22, 2018, pages 523–538, 2018; Cai, Linda, et al. "Selling to multiple no-regret buyers." International Conference on Web and Internet Economics. Cham: Springer Nature Switzerland, 2023. In this model, the buyer uses a standard "learning algorithm" to adjust their bids over time and the seller responds optimally to this buyer behavior. Importantly, the buyer is not best-responding to the seller's complex adaptive strategy, and so this analysis is non-equilibrium.

[257] Expert Report of P. Milgrom, ¶28.

[258] Expert Report of S. Wiggins, ¶19.

[259] *See* Expert Report of P. Milgrom, ¶303 ("publishers had an incentive to set value CPMs higher than the historical average revenues of demand sources, and there is evidence that many publishers did just that."); Expert Report of P. Milgrom, footnote 582.

Opening Report cited this evidence as well,[260] and it is my opinion that it is consistent with the Weinberg Framework in that Google's Deceptive Conduct should be evaluated *predominantly* by its impact on both Default Participants.

202. The Milgrom Report and the Wiggins Report emphasize the strong incentives of participants.[261] My Opening Report and Rebuttal Report agree that advertisers, publishers, Ad Buying Tools (and others) all have strong incentives to respond optimally within Google's Display Advertising RTB Ecosystem. This is consistent with the Weinberg Framework and does not distinguish the Milgrom Framework from the Weinberg Framework.

203. The Milgrom Report and Wiggins Report repeatedly emphasize that "[r]ather than calculating bids themselves, advertisers delegate many of the details of bid optimization to specialized buy-side tools,"[262] and instead delegate bidding strategies to more advanced tools that experiment and optimize. It is still fully consistent that advanced tools might believe Google's descriptions of its own products, especially via private communication, and that such tools might not detect Google's behavior over explicit attempts to conceal it.[263] In my opinion, this is consistent with the Weinberg Framework, and it also does not distinguish the Milgrom Framework from the Weinberg Framework. The Wiggins Report explicitly notes that GDN is once such tool that advertisers trust to optimize bids on their behalf.[264] For advertisers, it is my opinion that this concept reinforces the Weinberg Framework.

204. The Milgrom Report and the Wiggins Reports emphasize the prevalence of performance metrics to induce competition among Ad Buying Tools and exchanges. They further imply that

---

[260] *See* Expert Report of M. Weinberg, footnote 199 ("A sophisticated publisher could set the Value CPM however they like. If the publisher is sophisticated and revenue-maximizing, they would choose a Value CPM above the default. Recall that some publishers were indeed sophisticated and chose to do this. This is referred to as the "boost.").

[261] *See* Expert Report of P. Milgrom, ¶31 ("For many publishers and advertisers, there are vast sums of money at stake, and online display advertising makes up a significant fraction of their marketing revenue or spend."); Expert Report of S. Wiggins, ¶39 ("[A]dvertisers […] learn how to optimize returns on ad purchases through careful experimentation and monitoring of their spending. Publishers also generally monitor returns and conduct experiments to identify strategies to optimize their revenue.").

[262] Expert Report of P. Milgrom, ¶32.a.; *see also* Expert Report of S. Wiggins, ¶40 ("[A]dvertisers […] rely on numerous specialized intermediaries to help them implement optimal strategies.").

[263] █████████████████████████████████████████████████████████████████

[264] █████████████████████████████████████████████████████████████████

this competition itself is evidence of Sophisticated and Fully Informed Advertisers. In my opinion, this is a logical flaw because an advertiser can use multiple Ad Buying Tools, track their performance on each, and re-allocate budget to higher-performing tools while still using GDN suboptimally. That is, it is consistent for an advertiser to trust GDN and truthfully share its objectives while also evaluating GDN's performance when used in this manner.

205. ███████████████████████████████████████
███████████████████████████████████████
███████████████████████████████████████
███████████████████████████████████████
███████████████████████████████████████
██████████

206. The Milgrom Report ████████████████████████
███████████████████████████████████████
███████████████████████████████████████
██████████████ as evidence supporting that "[b]uy-side tools depend on considerable experimentation, employing various learning algorithms to optimize bids on behalf of advertisers. Through experimentation, these algorithms can automatically and almost immediately adapt to changes in the environment."[266] After thoroughly reviewing the sources cited by the Milgrom Report, this incident further supports the Weinberg Framework and does not provide evidence of buy-side tools "adapt[ing] to changes in the environment."

207. ███████████████████████████████████████
███████ ██ ████████████████████████████████
██████████████

208. DRSv1 uses a first-price payment in the dynamic region. DRSv2 uses a 1.5-price payment in the dynamic region. DRSv2 initially also used a 1.5-price payment when recollecting debt.[268]

---

[265] See GOOG-DOJ-14716780 at -80 and -82, ("[Criteo] team has found data suggesting that there is dynamic pricing. […] To me, this looks like a case of DRSv2.").

[266] Expert Report of P. Milgrom, ¶32.b.

[267] See GOOG-DOJ-14716953 at -58 ("[Criteo] certainly routinely do[es] this for AdX and other exchanges, I've seen examples of them "exposing" soft floors on other exchanges. They told me they aim to "boost" "clean" exchanges.").

[268] Specifically, DRSv2 recollected debt on transactions where the debtor's bid exceeds the truthful payment. The initial launch of DRSv2 collected debt on each transaction no more than half the difference between the bid and truthful payment (which

[REDACTED] [269]

209. [REDACTED]
[REDACTED] [270]

210. [REDACTED]
[REDACTED] [271]

211. In summary, it is my opinion that:

    i. [REDACTED]. That statement omits quite a bit of detail. Furthermore, to imply this incident is evidence of "buy-side tools [...] automatically and almost immediately adapt[ing] to changes in the environment" is also misleading and instead provides evidence to the contrary. [REDACTED]

[REDACTED]

[REDACTED]

---

caps the actual payment at the 1.5-price.) Other caps existed on the payment, but it is my opinion that those are not relevant for understanding this instance.

[269] [REDACTED]

[270] And indeed, deposition by a Google employee suggests this may not even be possible. *See* Deposition of Korula, Nitish, April 19, 2024, 316:18-317:25 ("Q. Well, is -- is -- is DRS either in version 1 -- I guess DRS version 2, would a buyer ever be able to observe if recollection has happened? A. I don't know that a buyer would be able to observe that it's happened on this query versus another query, but from the buyer's point of view they might be agnostic to that, right. They paid, you know, five dollars on one query and ten dollars on another query. If Google took a, you know, 19 percent revenue share on the ten dollar query and a 21 percent revenue share on the five dollar query, the publisher would get paid some amount so that's -- you know, the buyer doesn't necessarily observe how much went to the Google and how much went to the publisher on each individual query. Q. Okay. So, and then that -- and I think that's my question. I'm not ask if the buyer cares about the revenue share that Google takes. I'm asking if it's possible for the buyer to determine whether Google used this recollection mechanism. A. I don't believe it was possible for the buyer to observe that on any particular query. Ultimately they bid something. Google takes some share. The rest goes to the publisher, what they pay, what the buyer pays.").

[271] [REDACTED]
[REDACTED].

[272] Expert Report of P. Milgrom, ¶32.b.

[273] [REDACTED]

██████████████████████████████████████████████████

███████████████████████████

ii.  ██████████████████████████████████████████

██████████████████████████████████████████

██████████████████████████████████████████

██████████████████████████████████████████

██████████████████████████████████████████

████████████████████████████████████

iii.  The Wiggins Report cites an instance ████████████████████

████████████████████████████████████████████

████████████████████████████████  to support the claim that "there is evidence that advertisers not only monitor return metrics, but also use them to learn and optimize their strategies over time."[276] It is my opinion that the sources cited by Professor Wiggins further supports the Weinberg Framework and does not provide evidence of advertisers "learn[ing] and optimiz[ing] their strategies over time" for the following reasons:

iv.  ██████████████████████████████████████████

██████████████████████████████████████████

██████████████████████████████████████████

██████████████████████████████████████████

████[277]

---

[274] ████████████████████████████████████████████████████
████████████████████████████████████████████████████
████████████████████████████████

[275] ████████████████████████████████████████████████████
████████████████████████████████████████████

[276] Expert Report of S. Wiggins, ¶¶49, 52.

[277] GOOG-NE-05308018 at -19.

    v.   █████████████████████████████████████

        █████ 278

    vi.   █████████████████████████████████████

        █████████████████████████████████████

        ███████.279

    vii.   █████████████████████████████████████

        █████████████████████████████████████

        █████████████████████████████████████

        █████████████████████████████████████

        ████████████████████████████

    viii.   Summarizing this incident only as "identify[ing] the effects of RPO" omits material details. ███████████████████████████

        ██████████████████████████████ 281

212. In summary, applying first principles of Auction Theory, it is my opinion that the Milgrom Report and the Wiggins Report do not accurately distinguish the Weinberg and Milgrom Frameworks and in one case reinforce the Weinberg Framework over the Milgrom Framework. The clearest evidence of Sophisticated and Fully Informed behavior cited in the Milgrom Report is also cited in my Opening Report and is consistent with the Weinberg Framework that the impact of Google's Deceptive Conduct should be evaluated *predominantly* by its impact on Default Participants in the Google Display Advertising RTB Ecosystem. ████████ ██████████████████████████████████████ cited in the Milgrom Report and Wiggins Reports, which further reinforces the Weinberg Framework based on Auction Theory. In conclusion, the Milgrom Framework is not justified[282] and the Weinberg Framework is best-suited to evaluate the impact of Google's Deceptive Conduct.

---

278 ███████████████████████████████████████████

279 ███████████████████████████████████████████████
    ██████████████████████████████

280 ██████████████████████████

281

282 It is helpful to note when Google's Deceptive Conduct is detrimental in both the Milgrom and Weinberg Frameworks (for example, DRSv2 can only harm advertisers, even in the Milgrom Framework.) But it is my opinion that it is unreasonable to use the Milgrom Framework to evaluate the true impact of Google's Deceptive Conduct.

**K.    Professor Milgrom's Report Contests Many of My Initial Claims Only on the Basis of Contesting the Weinberg Framework.**

213.    Many claims from my Opening Report are contested *only* on the basis of contesting the Weinberg Framework. After providing justification for the Weinberg Framework, there are no further rebuttals to address regarding these claims. Later sections address Conduct-specific rebuttals. Below is a list of my opinions for which I find no other objection in Google's experts' reports:

      i.    "In my opinion, Dynamic Allocation led to higher win rate and higher revenue for AdX as well as lower win rate and lower revenue for non-Google exchanges. Additionally, if AdX typically transacts ads of lower quality than non-Google exchanges, Dynamic Allocation also led to an increase in the display of lower quality ads."[283]

      ii.    "Last Look advantage likely helped AdX have a higher win rate in comparison to AdX's win rate without Last Look advantage, by helping AdX clear impressions that would have otherwise been cleared by the header bidding winner."[284]

      iii.    "[O]ne interpretation of Exchange Bidding is that it creates two tiers: Exchanges that participate in header bidding and exchanges that participate in Exchange Bidding together with AdX. [...] AdX and Exchange Bidding exchanges have a Last Look advantage over exchanges that participate in header bidding, but do not have a Last Look advantage over each other, placing them in the top tier."[285]

      iv.    For each of the above three conclusions, the Weinberg Framework leads to the conclusion that publishers predominantly set Value CPMs according to Google's suggested text/formula. The Milgrom Report *only* objects to the use of the Weinberg Framework in my Opening Report, and *not* to any logical conclusions I draw towards these conclusions under the Weinberg Framework.

---

[283] Expert Report of M. Weinberg, ¶120.

[284] Expert Report of M. Weinberg, ¶159.

[285] Expert Report of M. Weinberg, ¶161.

v.    "In my opinion, Enhanced Dynamic Allocation likely led to an increase in win rate and increase in revenue for AdX."[286] "Under Enhanced Dynamic Allocation, impressions that otherwise would have been reserved for high priority line items such as direct deals are instead available for AdX's auction. [...] Furthermore, AdX is the only exchange that unconditionally has this opportunity."[287]

vi.   Technically, Google's experts do not appear to object to the letter of these claims, but they object instead to the spirit by noting that publishers could boost Value CPMs of header bidders in order to help header bidders better compete against direct deals and AdX. The Weinberg Framework obviates that argument, and there are no further objections to the spirit of these claims.

vii.  "Publishers would have set different reserve prices to maximize their revenues had Google revealed DRSv1."[288]

viii. "Publishers would have raised their reserve prices to maximize their revenue had they known about Projects Bernanke and Global Bernanke"[289] "Moreover, all publishers likely would have changed their behavior if they knew about Projects Bernanke and Global Bernanke by raising their reserve prices."[290]

ix.   For each of the above two conclusions, applying first principles of Auction Theory, it is my opinion that publishers predominantly set reserves according to the data received and assuming AdX ran a clean second-price auction (with fixed revenue share) under the Weinberg Framework. The Milgrom Report only objects to the Weinberg Framework, and not to my Opening Report's conclusions that publishers would set reserves differently in a clean second-price auction versus Google's modified auctions.

---

[286] Expert Report of M. Weinberg, ¶137.

[287] Expert Report of M. Weinberg, ¶139-140.

[288] Expert Report of M. Weinberg, ¶VII.D.1.

[289] Expert Report of M. Weinberg, ¶VIII.C.3.

[290] Expert Report of M. Weinberg, ¶250.

    x.    "DRSv2 leads to increased win rate and revenue for AdX in comparison to no DRS."[291]

    xi.    "DRSv1 was likely neutral to AdX advertisers' payoffs, although may have had some negative impact."[292]

    xii.    "DRSv2 led to a decrease in AdX advertisers' payoffs."[293]

    xiii.    "Projects Bernanke and Global Bernanke did not benefit GDN advertisers, but decreased win rates for advertisers using non-Google Ad Buying Tools."[294]

    xiv.    For each of the above four conclusions, applying first principles of Auction Theory, it is my opinion that under the Weinberg Framework, advertisers predominantly continued bidding their values into GDN/AdX because GDN is described as optimizing on behalf of advertisers, and AdX is described as a truthful second-price auction. The Milgrom Report only objects to the Weinberg Framework, and not to these conclusions within the Weinberg Framework.

    xv.    "Advertisers would have shaded their bids to maximize their payoff had they known about Projects Bernanke and Global Bernanke."[295]

    xvi.    "Advertisers would have submitted different bids to maximize their payoffs had Google revealed DRSv1."[296]

    xvii.    "Advertisers would change their bidding behavior had Google revealed RPO."[297]

    xviii.    For each of the above three conclusions, applying first principles of Auction Theory, it is my opinion that the Weinberg Framework leads to the conclusion that advertisers were not interacting optimally with Bernanke/DRS/RPO due to Google's Deceptive Conduct. The Milgrom Report objects to conclusions in my Opening Report that advertisers were not interacting optimally with

---

[291] Expert Report of M. Weinberg, ¶222.

[292] Expert Report of M. Weinberg, ¶225.

[293] Expert Report of M. Weinberg, ¶VII.F.1.

[294] Expert Report of M. Weinberg, Section VIII.E.1.

[295] Expert Report of M. Weinberg, Section VIII.E.2.

[296] Expert Report of M. Weinberg, Section VII.F.2.

[297] Expert Report of M. Weinberg, Section IX.B.1.

Bernanke/DRS/RPO (because the Milgrom Framework posits that everyone interacts optimally no matter how deceptive Google tries to be), and not to the fact that Bernanke/DRS/RPO change how advertisers would optimally interact with GDN/AdX.

## VI.  APPLYING FIRST PRINCIPLES OF AUCTION THEORY, THE OPINIONS EXPRESSED IN THE MILGROM REPORT ARE INCORRECT.

### A.    The Milgrom Report's analysis contradicts itself.

214.  The Milgrom Report claims both that participants will optimize their behavior, *and* that Google should keep its programs secret to prevent participants from optimizing their behavior.

a.    "even for those programs for which details are not disclosed at all, advertisers' and publishers' routine data analysis and experimentation with bids and floor prices are typically sufficient for them to identify optimal strategies."[298]

b.    "processes for setting reserve prices, like those for computing bids, are routinely kept secret to avoid other participants exploiting the details of those processes to their own advantage, at the expense of the publisher. The concealment of a program like RPO serves the publisher's interests and should be expected by advertisers."[299]

c.    "In reality, processes for setting reserve prices and determining bids in auctions are routinely kept secret to prevent other auction participants from gaming these strategic choices."[300]

d.    The Milgrom Report here claims *both* that Google's Deceptive Conduct should be evaluated as if advertisers optimally responded[301] *and* that keeping Google's Deceptive Conduct secret would prevent participants from best responding. But Google concealed its Deceptive Conduct in order to prevent auction participants from best responding, and succeeded.

215.  The Milgrom Report claims both that participants will optimize their behavior no matter what, *and* that simplicity is an important aspect of auction ecosystems:

---

[298] Expert Report of P. Milgrom, ¶32.

[299] Expert Report of P. Milgrom, ¶412. To clarify, "exploiting the details of those processes to their own advantage" is synonymous with "respond[ing] to auction programs."

[300] Expert Report of P. Milgrom, ¶32.

[301] Implicitly, because they will do so even if that Deceptive Conduct is kept secret.

a.  "even for those programs for which details are not disclosed at all, advertisers' and publishers' routine data analysis and experimentation with bids and floor prices are typically sufficient for them to identify optimal strategies."[302] (Emphasis added).

b.  "In my own auction consulting in this industry and others, I have emphasized the importance of making bidding easier to encourage participation and promote value creation. For example, in my published advice as consultant to the US Federal Communications Commission, I wrote that "the auction process needs to be simple and easy enough to encourage and facilitate the participation of a wide array of broadcasters […] [and] make it very easy for broadcasters to make optimal bids."[303]

c.  "Making participation safer: Intermediaries often design and enforce rules to protect participants from being taken advantage of by other participants on the platform. A lack of safety can force participants to spend resources monitoring and strategizing to protect against unscrupulous behavior. Such expenses can be wasteful and discourage participation."[304]

d.  "Bidder-truthful auctions reduce bidding errors and the costs of bidding because they eliminate any need for an advertiser to assess who else might be bidding, how much they might bid, or the publisher's floor price. In non-bidder-truthful auctions, each advertiser's bid depends on all of these factors. I have previously advised auctioneers to adopt bidder-truthful auctions, highlighting the importance of easy bidding."[305]

e.  "Moreover, the second-price auction ensured that, on each impression won by AdX bidders, the winning bidder paid only the amount needed to beat other bids on AdX and the floor price determined by the publisher, and not more, which as I explained before, made bidding simpler for advertisers."[306]

---

[302] Expert Report of P. Milgrom, ¶32.

[303] Expert Report of P. Milgrom, ¶43.a.

[304] Expert Report of P. Milgrom, ¶43.b.

[305] Expert Report of P. Milgrom, ¶63.

[306] Expert Report of P. Milgrom, ¶272. This quote is used to tout the benefits of Dynamic Allocation, during a period before all of the Deceptive Conducts described in this report made AdX no longer a second-price auction. In particular, the Deceptive Conducts described in this report make it so that the winner no longer pays "only the amount needed to beat other bids on AdX and the floor price determined by the publisher."

    f.    The Milgrom Report here claims both that it should be "very easy [...] to make optimal bids"[307] and that advertisers will anyway optimally respond to complex conducts like RPO and DRSv2 without "spend[ing] resources monitoring and strategizing to protect against unscrupulous behavior."[308]

216.    The Milgrom Report takes issue with "dirty" auctions when done by non-Google exchanges, but finds no issues when Google does *exactly the same thing*.

    a.    *"*Poirot also protected DV360 advertisers from misleading tactics from exchanges that ran so-called "dirty auctions," in which the exchange claimed to use one auction format to sell an impression, but actually used another."[309]

    b.    "Some exchanges ran what Google engineers called dirty auctions, meaning that they claimed to run a second-price auction but actually tried to extract additional payments from bidders by charging the winner a price between its own bid and the highest losing bid."[310]

    c.    "Dirty auctions also fail to be bidder-truthful and may be even more challenging for bidders, since a bidder may need to monitor its auction performance over time to detect changes in the auction format and adapt bids accordingly."[311] (Emphasis added).

    d.    "Another example, relevant in online display advertising, is a non-transparent auction, in which the auctioneer might claim to calculate winners and payments according to one rule, but actually charges bidders according to another rule. Because it is so easy to detect the first-price rule, an auctioneer running a non-transparent auction might claim to use a second-price auction but actually use the 1.5-price rule, hoping to confuse bidders into bidding too much, increasing the auctioneer's profit."[312]

---

[307] Expert Report of P. Milgrom, footnote 53.

[308] Expert Report of P. Milgrom, ¶43.b.

[309] Expert Report of P. Milgrom, ¶216.a.

[310] Expert Report of P. Milgrom, ¶217.

[311] Expert Report of P. Milgrom, ¶219.

[312] Expert Report of P. Milgrom, ¶69.

e.  It is implicit throughout the Milgrom Report that it does not find Project Bernanke or DRS to be "misleading" or "challenging for bidders". Both Project Bernanke and DRSv1 are "dirty" auctions, and DRSv2 used a 1.5-price rule in the dynamic region.

f.  The Milgrom Report here claims *both* that "dirty" auctions are misleading when used by non-Google exchanges, *and* that they are not misleading when Google does the same.

217.  The Milgrom Report takes issue when price-fishing causes complexity in Google's Display Advertising RTB Ecosystem, but has no issue when Google's own Deceptive Conduct causes the exact same complexity.

a.  The Milgrom Report takes issue with price-fishing because "Gaming floor prices in this way damages the safety and simplicity of Google's platform because the advertiser cannot rely on the floor price reported at an exchange being the publisher's lowest acceptable price for the impression."[313]

b.  But, the Milgrom Report finds DRSv1 and DRSv2 to be "helping publishers sell more impressions and increasing their revenues,"[314] even though they cause *exactly the same uncertainty* – DRS exactly causes impressions transacted through AdX to be winnable below the reported AdX reserve.[315]

**B.  The Milgrom Report relies on documents contrary to its stated conclusions.**

218.  The Milgrom Report states: "These claims [that buyers and publishers were not able to respond optimally to DRS because Google "concealed material information"] of deception are contradicted by disclosures in the AdX Help Center starting from at least August 2015."[316] The Milgrom Report then cites a disclosure concerning DRSv1 and DRSv2.

a.  The cited DRSv2 disclosure itself contains a *false statement*: "Regardless of whether any adjustments are made, the winning buyer will never be charged more than the bid

---

[313] Expert Report of P. Milgrom, ¶534.

[314] Expert Report of P. Milgrom, ¶425.

[315] Expert Report of P. Milgrom, ¶426 ("Under DRS v1, AdX would first determine for each impression if the highest bid it had received was in the "dynamic region," meaning that the bid would not clear the floor price if AdX charged its standard revenue share on that impression, but the bid would clear the floor price if AdX selected a 0% share.")

[316] Expert Report of P. Milgrom, ¶468.

it submits."[317] Therefore, the disclosure itself is deceptive, and provides evidence *counter* to the Milgrom Report's claim.

    b.    The cited DRSv1 disclosure is also deceptive, as noted in Section IV.-- it explains away an anomaly of DRSv1 (winning below the reserve and paying your bid) as "auction optimizations".[318]

    c.    The Milgrom Report provides no argument connecting the text of the DRS disclosures to how they could possibly help buyers or publishers respond optimally to DRS. As noted above, the text of the DRS disclosures *further explains why buyers and publishers did not respond optimally to DRS*.

219. The Milgrom Report claims: "Buy-side tools depend on considerable experimentation, employing various learning algorithms to optimize bids on behalf of advertisers. Through experimentation, these algorithms can automatically and almost immediately adapt to changes in the environment. ███████████████████████████████████████████ ███████████████████████████████████████████ ███████████████████████████████████████████ ███████████████████████████████████████████ ████████████████████████."[319]

    a.    Both references are used in this paragraph to support the Milgrom Report's claim that "Plaintiffs' Experts' Analyses Underestimate the Role of Experimentation for Optimizing Returns."[320] Both cited documents provide evidence to the contrary instead.

    b.    ███████████████████████████████████████████ ███████████████████████████████████████████ ███████████████████████████████████████████ ███████████████████████████████████████"[321] (*Emphasis added*)

---

[317] GOOG-AT-MDL-C-000035252 at -52. I stated in my Opening Report, and previously, that I find this statement to be false because it does not account for debt. The Milgrom Report does not rebut my claim.

[318] GOOG-AT-MDL-C-000035251 at -51.

[319] Expert Report of P. Milgrom, ¶32.b.

[320] Expert Report of P. Milgrom, Section II.B.4.

[321] *See* "Display Ads Research Meeting Notes" (Jun. 19, 2017), GOOG-TEX-00831373, at -378.

This quote does not, in fact, support that buy-side tools are learning to optimize on behalf of advertisers – it shows the opposite.[322]

    c.    For the second source, ███████████████████████████ ███████████████████████████████████████ This again shows the opposite – experiments are insufficient to optimize against Google's Deceptive Conduct.

220.  For each of Google's seven Deceptive Conducts considered in this report, the Milgrom Report alleges that other tools engaged in similar Deceptive Conduct.

    a.    For four of these (Project Bernanke, Enhanced Dynamic Allocation, RPO, DRS), their is my opinion that the evidence is insufficient to justify such claims.

    b.    Several cited examples are simply similar buzzwords in a marketing deck.[323] ████ ███████████████████████████████████████ ████████████████████████.[324] [325]

    c.    In other examples, the Milgrom Report seems to allege two programs are similar simply because they address the same challenge and use a similar framework, without making *any* attempt to determine whether Plaintiff's (and their experts') complaints would apply to the allegedly similar Deceptive Conduct. In some cases, there is even sufficient information to conclude that Plaintiff's complaints would *not* apply to the allegedly similar Deceptive Conduct.[326]

---

[322] ███████████████████████████████████████ ███████████████████████████████████████ ███████████████████████████████████████ ███████████████████████████████████████

[323] For example, see Expert Report of P. Milgrom, footnote 608 (████████████████████████████████.)

[324] *See* Expert Report of P. Milgrom, ¶388 ("██████████████████████████ ███████████████"); footnote 608. ████████████████

[325] The Wiggins report similarly mistakenly claims ██████████████████PO. *See* Expert Report of S. Wiggins, ¶86.

[326] For example, see Expert Report of P. Milgrom, ¶171 ("Non-Google buying tools adopted similar programs to Bernanke.") *See* also, ███████████████████████████████████████ ███████████████████████████████████████

221.   The Milgrom Report mischaracterizes quotes from the Weinberg Opening Report regarding Project Bernanke,[327] Dynamic Allocation,[328] and Last Look.[329]

## VII. APPLYING FIRST PRINCIPLES OF AUCTION THEORY, OPINIONS OF GOOGLE'S EXPERTS' REGARDING PROJECT BERNANKE ARE INCORRECT.

222.   After careful review of Google's experts' rebuttals, I still maintain all opinions in my opening report concerning Project Bernanke and its variants. This section responds to critiques in the Milgrom Report.

223.   First, the Milgrom, Wiggins, and Baye Reports claim that Project Bernanke's impact should be evaluated according to the Milgrom Framework as opposed to the Weinberg Framework.[330] I disagree, and still believe the Weinberg Framework is most appropriate to evaluate Project Bernanke's impact. Section V. above discusses this point.

224.   Second, the Milgrom Report claims that Project Bernanke should be viewed as a "bidding strategy" on behalf of GDN bidders,[331] and further claims that concealing Project Bernanke "benefited Google's customers."[332] Because Project Bernanke and Global Bernanke did not bid in the best interest of GDN advertisers, it is more accurately viewed as an auction modification rather than a bidding strategy.[333] [334] Concealing Project Bernanke did not benefit GDN advertisers. To the contrary, concealing Project Bernanke prevented GDN advertisers from optimizing the information shared with GDN, and instead Google deceived advertisers into believing GDN was optimizing on their behalf.

---

[327] *See* Section VII.

[328] *See* Section VIII.

[329] *See* Section X.

[330] *See* Expert Report of P. Milgrom, Section IV.D.2 ("Bernanke […] Did Not Deceive Publishers or Advertisers"); Expert Report of S. Wiggins, ¶227 ("[T]here is no basis to assume that advertisers would have altered their bidding strategies had Google disclosed Bernanke sooner and, thus, no basis to conclude that Google's profit was higher in the actual world than it would have been in the but-for world without the alleged deception about Bernanke.").

[331] Expert Report of P. Milgrom, ¶172 ("[A]s one Google employee noted, the introduction of Bernanke 'is similar to other third party buyers changing their bidding behavior which we never announce and is confidential to the buyer.'")

[332] Expert Report of P. Milgrom, Section IV.D.6 ("Confidentiality About Bidding Practices […] Benefited Google's Customers".)

[333] During periods when Global Bernanke used a first-price payment rule instead of threshold payments.

[334] Indeed, Professor Milgrom's *own report* takes this stance as well. "When Google Ads is called to bid on an impression, it uses an internal process which I will call the **Google Ads internal auction** (and which Google employees refer to as the "Google Display Network (GDN) Auction," the "CAT2" auction, or the "pre-auction".)" Expert Report of P. Milgrom, ¶90.

225. Third, the Milgrom Report claims that other ad buying tools used programs like Project Bernanke. ████████████████████████████████.[335] An inspection of the documents cited in the Milgrom Report indicates that the described programs are not "similar programs to Bernanke."[336]

226. Fourth, the Milgrom Report claims it is a "mischaracterization of Project Bernanke"[337] when my opening report identifies Project Bernanke as facilitating collusion among GDN bidders. I maintain my opinion that Project Bernanke "simultaneously facilitat[es] the effect of collusion among GDN advertisers, without their knowledge, and overbidding in auctions."[338] In particular, I rebut each of the three claims in the Milgrom Report.

227. Fifth, the Wiggins Report makes a significant and material logical error when evaluating the impact of Project Bernanke under the "DCMB Framework." This error undercounts the impact of Project Bernanke under the "DCMB Framework," so I correct this error.

228. Sixth, this section expands on my Opening Report's claim that concealing Project Bernanke is deceptive towards publishers.

229. Finally, this section reaffirms the following opinions from my Opening Report.

230. "Project Global Bernanke led to revenue reduction in some publishers."[339]

231. "Projects Bernanke and Global Bernanke can lead to a reduction in ad quality as well as revenue per mille for publishers."[340]

232. "Publishers would have raised their reserve prices to maximize their revenue had they known about Projects Bernanke and Global Bernanke."[341]

---

[335] Expert Report of P. Milgrom, ¶127.c ("non-Google buying tools used similar programs to optimize their bids."); footnote 226; ¶171 ("Non-Google buying tools adopted similar programs to Bernanke, including omitting or reducing the second bids in the AdX auction and collecting negative revenue shares on some impressions."); footnote 333.

[336] Expert Report of P. Milgrom, ¶171.

[337] Expert Report of P. Milgrom, ¶169.

[338] Expert Report of M. Weinberg, ¶233.

[339] Expert Report of M. Weinberg, Section VIII.C.1.

[340] Expert Report of M. Weinberg, Section VIII.C.2.

[341] Expert Report of M. Weinberg, Section VIII.C.3.

233. "Under Projects Bernanke and Global Bernanke, GDN increased its revenue at the expense of non-Google ad buying tools."[342]

234. "Projects Bernanke and Global Bernanke did not benefit GDN advertisers, but decreased win rates for advertisers using non-Google ad buying tools."[343]

235. "Advertisers would have shaded their bids to maximize their payoff had they known about Projects Bernanke and Global Bernanke."[344]

236. "When combined with (Enhanced) Dynamic Allocation, Projects Bernanke and Global Bernanke enabled AdX to have a higher win rate, which would cause other exchanges to have a lower win rate."[345]

## A.    Project Bernanke's impact should be evaluated according to the Weinberg Framework.

237. My Opening Report evaluated Project Bernanke's impact according to the Weinberg Framework, focusing on Default Advertisers who truthfully report their objectives to GDN.[346] The Milgrom Report contests this analysis and claims a proper analysis should instead use the Milgrom Framework and focus on Sophisticated Advertisers who optimize their inputs to GDN.[347]

238. As discussed in Section V., the Weinberg Framework applies instead of the Milgrom Framework. Therefore, any rebuttals by Google's experts that only contest the Weinberg Framework are incorrect.

239. Moreover, Theorem 1 of the Milgrom Report has a hidden assumption that requires the Milgrom Framework.[348] Because the Weinberg Framework, rather than the Milgrom

---

[342] Expert Report of M. Weinberg, Section VIII.D.1.

[343] Expert Report of M. Weinberg, Section VIII.E.1.

[344] Expert Report of M. Weinberg, Section VIII.E.2.

[345] Expert Report of M. Weinberg, ¶262.

[346] See Expert Report of M. Weinberg, Section VIII.E.2.

[347] See Expert Report of P. Milgrom, ¶145 ("I fully account for the incentives for […] Google Ads advertisers to change their bids in response to the bid optimization programs.").

[348] Specifically, when the report invokes the "revelation principle" in its proof, the report implicitly assumes that bidders are best-responding in Bayes-Nash equilibrium. During periods when Project Bernanke and Global Bernanke used a first-price payment rule, this assumption holds only for Sophisticated Advertisers and *not* for Default Advertisers. During periods where Project

Framework, is best-suited to analyze the impact of Google's Deceptive Conduct, Theorem 1 of the Milgrom Report and all conclusions derived from it are irrelevant.[349]

### B.     Project Bernanke is an auction modification and should be disclosed.

240. The Milgrom Report considers Project Bernanke a "bidding strategy,"[350] and claims that concealing it "benefited Google's customers."[351] Based on the evidence, I disagree.

241. In my opinion, a "bidding strategy" should aim to optimize the objectives of the bidder, who in this case is an advertiser. Buy-Side DRS, Project Bernanke, and Global Bernanke[352] did not optimize on behalf of GDN advertisers, so in my opinion it is unreasonable to call it a "bidding strategy."

242. Instead, these Project Bernanke variants, had they been disclosed, would have created a new auction game for GDN advertisers to play: they should strategically decide what information to share with GDN (so this information can now be thought of as their "bids"), and once all GDN and non-GDN bidders have submitted their bids, Project Bernanke and AdX define an allocation rule (who wins the impression) and a pricing rule (how much the winner pays).

243. Therefore, it is my opinion that concealing Project Bernanke is closer to an auctioneer concealing aspects of the auction format from some bidders much more so than a bidder concealing aspects of their bidding strategy from rivals.

244. Numerous internal Google documents support this view too, and refer to GDN's internal mechanism that decides which bids to submit to AdX as the "CAT2 auction."[353]

---

Global Bernanke used threshold payments, both Sophisticated and Default Advertisers would best-respond by bidding truthfully (because the auction is actually truthful.)

[349] During periods where the Weinberg and Milgrom Frameworks disagree (i.e. when Project Bernanke and Global Bernanke used a first-price payment rule, and therefore Sophisticated and Default behavior differ).

[350] Expert Report of P. Milgrom, ¶172.

[351] Expert Report of P. Milgrom, Section IV.D.6 ("Confidentiality About Bidding Practices […] Benefited Google's Customers".)

[352] During periods with a first-price payment rule.

[353] Design Doc, "Dynamic Revshare for AdWords on AdX" (Jul. 13, 2012), GOOG-DOJ-13605152, at -152 ("Currently, AdWords runs an auction (aka CAT2 auction, pre-auction) to select the highest bidding creative (or bundle of creatives) to compete in the AdX auction.") Also called the "CAT2 auction." GOOG-NE-11753797 at -37. February 11, 2019. "DVAA Quality, Formats, O&O - Q1 2019 All Hands."

245. Moreover, the Milgrom Report supports this view too, referring to GDN's internal mechanism that decides which bids to submit to AdX as the "Google Ads Internal Auction".[354] [355] [356]

246. The Milgrom Report asserts that concealing Project Bernanke "benefited Google's customers."[357] As discussed in Section IV., concealing Project Bernanke was deceptive towards GDN advertisers, and prevented them from optimizing their provided inputs to GDN.

**C.    The Milgrom Report fails to provide convincing evidence of competitors using programs similar to Project Bernanke.**

247. The Milgrom Report seems to excuse Google's Deceptive Conduct with respect to Project Bernanke by claiming that other ad buying tools implemented "similar programs to Bernanke," ███████████████████████████.[358] [359] A thorough review of both documents cited in the Milgrom Report indicates that these programs are not "similar to Bernanke."[360]

248. There are three key elements to variants of Project Bernanke that I address in my Opening Report: (a) some variants induce a non-truthful auction for GDN bidders, (b) all variants facilitate collusion among GDN bidders,[361] without their knowledge, (c) all variants induce widespread overbidding.

249. The descriptions ███████████████████ do not provide evidence suggesting that either induced a non-truthful auction ███████████████████.[362] The Milgrom Report does

---

[354] Expert Report of P. Milgrom, ¶90.

[355] The Baye Report also refers to it as an auction "When an impression becomes available, **Google Ads first solicits bids from its advertisers in an internal auction** designed to identify each advertiser's "value," or the maximum they are willing to pay, for the impression." (Expert Report of M. Baye, ¶601)

[356] Not all sources refer to this process as an auction. For example, Dr. Jayaram instead refers to it as a "value estimation" (*See* Deposition of Nirmal Jayaram, p. 318.) Note, however, that Professor Milgrom's report uses this language interchangeably with the auction language.

[357] Expert Report of P. Milgrom, Section IV.D.6.

[358] Expert Report of P. Milgrom, ¶127.c ("non-Google buying tools used similar programs to optimize their bids.") , footnote 226, ¶171 ("Non-Google buying tools adopted similar programs to Bernanke, including omitting or reducing the second bids in the AdX auction and collecting negative revenue shares on some impressions.") And footnote 333.

[359] The Baye Report additionally ███████████████ supporting the claim "This means that Google Ads' rivals could have implemented similar programs, and in fact, some rivals did offer competing solutions." (Expert Report of M. Baye, ¶612)

[360] Expert Report of P. Milgrom, ¶171.

[361] I acknowledge that the Milgrom Report contests my use of the term "collusion" to describe this aspect, which I respond to later in this section.

[362] ███████████████████████████████████████████████████████

HIGHLY CONFIDENTIAL

not allege this either, beyond a general allegation that the programs are "similar to Bernanke." [363]

250. The descriptions ████████████████████ do not provide evidence suggesting either facilitated collusion among their advertisers.[364] The Milgrom Report does not allege this either, beyond a general allegation that the programs are "similar to Bernanke."[365]

251. ████████████████████████████████████████
████████████████████████████████████████
███████████████████████████████████ [366]
████████████████████████████████████████
████ [367]

252. ████████████████████████████████████████
[368] ████████████████████████████████████████
████████████████████████████████████████
███████████████████████████████ [369]

---

[363] Expert Report of P. Milgrom, ¶171.

[364] The documents the Milgrom Report cites, and that I have access to, are not fully specified launch docs. ████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████████

[365] Professor Milgrom does allege that other ad buying tools submitted only a single bid into second-price exchanges, which my opening report identifies as similarly facilitating collusion among its advertisers. *See* Expert Report of M. Weinberg, Appendix H.1.

[366] ████████████████████████████████████████████████████████

[367] ████████████████████████████████████████████████████

[368] Expert Report of P. Milgrom, ¶171.

[369] In fact, I would go further and claim it is misleading for the Milgrom Report to claim these programs are "similar to Bernanke". It is fair to say that "one-bid" policies share Bernanke's collusion aspect, and it is fair to claim that ████████████ may have Bernanke's widespread overbidding aspect. But ████████████ shares none of the three key Bernanke elements, and the report provides no evidence of a single program possessing more than one element (nor any program inducing an untruthful auction for its advertisers.)

**D.      Project Bernanke did facilitate collusion between GDN and GDN advertisers.**

253.    The Milgrom Report claims it is a "mischaracterization of Project Bernanke"[370] to say it facilitated collusion among GDN bidders without their knowledge. The report provides three arguments for this claim, which I refute below.

254.    My Opening Report states that "Project Bernanke and all its variants can be understood as simultaneously facilitating the effects of collusion among GDN advertisers, without their knowledge, *and overbidding in auctions*."(*emphasis added*).[371] The Milgrom Report omits the emphasized portion of the above statement when quoting my Opening Report, and this omission results in a strawman argument.

255.    The Milgrom Report claims "collusion typically harms sellers in auctions, but Bernanke resulted in *higher revenues* for publishers, as confirmed by Google's experiments."[372]

256.    But my Opening Report is clear that the collusion aspect of Project Bernanke "**in isolation** would be a pure transfer of funds from exchange/publisher to GDN"[373] (*emphasis added*), and the overbidding aspect (which the Milgrom Report omits) "uses the savings from the first half... to subsidize overbidding"[374] which causes the exchange/publisher to see increased revenues.

257.    In other words, Project Bernanke combines a collusive aspect (which indeed harms publishers' revenue, as the Milgrom Report expects from collusion, and my Opening Report claims) and an overbidding aspect (which helps publishers' revenue). It is fully consistent for two aspects to jointly improve publishers' revenue, with one aspect decreasing revenue and the other increasing it.

258.    The Milgrom Report's argument is thus either a mischaracterization of my report—"Project Bernanke as a whole is collusion and nothing else," or a basic logical flaw—"Because all aspects of Project Bernanke increase publisher revenue when taken together, each individual aspect of Project Bernanke must not decrease revenue."

---

[370] Expert Report of P. Milgrom, ¶169.

[371] Expert Report of M. Weinberg, ¶233.

[372] Expert Report of P. Milgrom, ¶170.

[373] Expert Report of M. Weinberg, ¶233.

[374] Expert Report of M. Weinberg, ¶233.

259.  The Milgrom Report also claims "when bidding rings participate in a second-price auction, a winning bidder in the ring would pay just enough to beat the bids submitted by other bidders outside of the conspiracy. But under Project Bernanke, a winning advertiser on Google Ads always paid a price at least as high as the second-highest Google Ads bid, which was often higher than the highest bid submitted by other buying tools."[375] This is also simple to address, by correcting Prof. Milgrom's definition of "the ring" to include GDN itself.[376]

260.  When "the ring" includes GDN itself, it is indeed true that "the ring" pays AdX "just enough to beat the bids submitted by other bidders outside of the conspiracy," exactly as the Milgrom Report expects.

261.  The Milgrom Report notes that the GDN *advertiser* does pay more than this amount,[377] but any payment exceeding this *goes to GDN and not to AdX.*

262.  Last, the Milgrom Report claims "collusion generally entails reduced output, but Bernanke was a bid-optimization program that increased the number of impressions sold."[378] This is not accurate.

263.  It is simply not the case that "*collusion generally* entails reduced output."(emphasis added) [379] One common form of collusion is indeed among producers (i.e. of oil) who explicitly collude *to reduce output* in order to keep the price of their (now supply-limited) output high. But *collusion generally* could entail any coordinated behavior, not necessarily with intent to reduce output.[380]

264.  To repeat an example from my opening report, when several high school friends get together and agree to drop all but the highest bid into an auction, there is no expectation of "reduced

---

[375] Expert Report of P. Milgrom, ¶170.

[376] I also note that I walked through, in great detail, an example of exactly this kind of standard collusion in my Opening Report (*See* Expert Report of M. Weinberg, Appendix H.1.) In that example, the colluding bidders partner with an intermediary so that the payment leaving "the ring" is indeed the minimum payment necessary to beat the non-conspirators, and there is also payment from bidders to the intermediary (who is part of "the ring".)

[377] The Milgrom Report also claims "[Project Bernanke] decreased the prices paid by Google Ads advertisers on some impressions (namely, those impressions on which Google Ads submitted the two highest bids on AdX.)" (Expert Report of P. Milgrom, ¶161.) This is the exact same wordplay but in the opposite direction. Indeed, Google Ads *advertisers* do *not* pay less (as Professor Milgrom correctly states when raising this objection) -- only Google Ads *itself* pays less.

[378] Expert Report of P. Milgrom, ¶170.

[379] Expert Report of P. Milgrom, ¶170.

[380] For example, when two soccer teams collude to fix their match, this is a fundamentally different form of collusion, and there is no sense in which it should entail "reduced output" (as there is no output).

output" – the same bidder will win the item as if there were no collusion, but if that bidder is part of "the ring," they may pay less.

265. This argument appears to conflate one specific form of collusion (intentionally reducing output to inflate prices) with all forms of collusion, and claims that all forms of collusion generally entail the same aspects as this one specific form, which is false.

266. Moreover, the "overbidding" half of Project Bernanke (which the Milgrom Report omits when quoting my opening report) is clearly responsible for increasing the number of impressions sold, and not the "collusion" half of Project Bernanke.

267. In summary, I maintain my opinion that a proper lens to understand all variants of Project Bernanke is that it simultaneously facilitated collusion among GDN bidders (without their knowledge) and overbid on their behalf.

**E.    The Wiggins Report makes significant and material mistakes implementing the "DCMB Framework" for Project Bernanke.**

268. When executing the "DCMB Framework", the Wiggins Report concludes that "transactions won by Google Ads where non-Google Ads bidders set the clearing price"[381] could not be affected in "(i) the clearing price, (ii) the winning bidder, (iii) whether the transaction cleared on AdX, or (iv) AdX's revenue share"[382] if only GDN advertisers shaded their bids, but non-GDN bids remained constant. Section IV. provides a simple example demonstrating a logical flaw in this claim, and describes why this is relevant for Professor Wiggins' execution of the "DCMB Framework."

269. In that example: (a) Google Ads wins, (b) a non-Google Ads bidder sets the clearing price, and (c) if Google Ads were to bid-shade, this could change both (i) the clearing price, and (ii) the winning bidder.

270. The top Google Ads bidder bids $12, the top non-GDN AdX bidder bids $10, the AdX reserve is $8, and the second-top Google Ads bidder is $7. Then in the example, Google Ads wins, and a non-Google Ads bidder sets the clearing price (of $10). If the top Google Ads bidder were to

---

[381] Expert Report of S. Wiggins, ¶158.

[382] Expert Report of S. Wiggins, ¶142.

bid-shade to \$9, then the impression would clear at \$9 instead of \$10, and the non-Google Ads bidder would now win. So both the clearing price and winner have changed.

271. As the above example shows, the Wiggins Report's claim that there is "no reason to believe that transactions where the AdX clearing price was set by non-Google Ads bidders would have been impacted by the alleged deception related to Bernanke"[383] is simply wrong. To the contrary, there is good reason to believe that transactions where the AdX clearing price was set by non-Google Ads bidders would have been impacted by Google's Deceptive Conduct related to Bernanke.

**F.    All variants of Project Bernanke are deceptive towards publishers.**

272. In response to points raised by Google's experts, I elaborate on my opinion that Google's decision to conceal all variants of Project Bernanke is deceptive towards publishers.[384]

273. An attentive publisher who regularly optimizes price floors would process their received bid data, and set an optimal reserve using Myerson's theory of optimal auctions.[385] Importantly, properly processing this data requires reverse engineering the bid distribution *of a single advertiser*, rather than just the bid distribution *of the maximum advertiser*.[386] The "collusion" aspect of Project Bernanke ruins this process in two ways.

274. First, when a group of advertisers colludes in either a second-price or first-price auction, the publisher should instead price that group as a single bidder.[387] Therefore, a publisher

---

[383] Expert Report of S. Wiggins, ¶157.

[384] This is in response to the Wiggins Report, which states "However, neither Mr. Andrien nor Professor Weinberg has articulated a theory for how the alleged deception regarding Alchemist impacts auction participants" (Expert Report of S. Wiggins, ¶162) and "neither Mr. Andrien nor Professor Weinberg has provided any economic theory or empirical evidence to suggest that advertisers or publishers would have behaved differently had Alchemist been disclosed." (Expert Report of S. Wiggins, ¶163.)

[385] Myerson, Roger B. "Optimal auction design." Mathematics of operations research 6.1 (1981): 58-73. Note that both my Opening Report and the Milgrom Report adopt Myerson's model for analysis.

[386] Myerson, Roger B. "Optimal auction design." Mathematics of operations research 6.1 (1981): 58-73.

[387] Imagine that an auction has 1000 advertisers, and imagine that the publisher believes all values to be drawn uniformly and independently from [0,1]. Then the optimal auction with no collusion is a second-price auction with reserve 1/2. With collusion, a second-price auction with reserve 1/2 achieves revenue at most 1/2 (because the colluders would never second-price themselves.) A better option with colluding advertisers would be to treat them as a single bidder whose value is drawn according to the maximum of 1000 independent and uniform draws from [0,1]. The optimal reserve in this case is much closer to 1 and would result in revenue close to 1 (for example, a reserve of 0.99 would clear with probability 99.99% -- the optimal reserve can only be better.)

processing bids from a collusive ad buying tool should instead set prices based only on the bid distribution of the winning advertiser rather than a single advertiser.

275. Second, even the publisher's process for reverse-engineering a single advertiser's bid is corrupted. It is my opinion that concealing Project Bernanke (all forms) during periods when AdX ran a second-price auction is deceptive towards publishers, because it is my opinion that publishers would reasonably believe GDN's two submitted bids to be its two highest advertiser bids, and process them as such, when it is instead optimal to process them differently. Similarly, it is my opinion that concealing the Alchemist during periods when AdX ran a first-price auction is deceptive towards publishers, because it is my opinion that publishers would reasonably believe GDN's top submitted bid to be optimized against the entire bidding population rather than just non-GDN bidders. This again would cause the reverse-engineering process to be incorrect.

276. In summary, it is my opinion that a publisher who is not aware of Project Bernanke's collusive aspect would try to reverse-engineer a single advertiser's value distribution in order to optimally set reserves. The collusive aspect of Project Bernanke (a) corrupts this process, so their estimate is inaccurate, and (b) makes this the wrong objective anyway, as the publisher should instead be pricing the entire pool of GDN advertisers as a single bidder.

277. Because bid distributions are material to publishers for the purpose of optimizing revenue, and concealing Project Bernanke (all variants) renders publishers incapable of relying on bid distributions computed as if they were submitted to AdX's stated auction format, it is my opinion that concealing Project Bernanke (all variants) is deceptive towards publishers.

### G.    Google's Expert Reports Do Not Affect my Opinions in my Opening Report.

278. "Publishers would have raised their reserve prices to maximize their revenue had they known about Projects Bernanke and Global Bernanke."[388]

279. "Advertisers would have shaded their bids to maximize their payoff had they known about Projects Bernanke and Global Bernanke."[389]

---

[388] Expert Report of M. Weinberg, Section VIII.C.3.

[389] Expert Report of M. Weinberg, Section VIII.E.2.

280. Google's experts do *not* contest that advertisers and publishers would behave differently in Display Advertising RTB Ecosystems with or without Project Bernanke. Google's experts *only* contest the above two conclusions by attacking the Weinberg Framework (which concludes that advertisers and publishers were *not* already best-responding to Project Bernanke, due to Google's Deceptive Conduct). As I maintain my opinion that the Weinberg Framework is significantly more justified than the Milgrom Framework, as discussed in Section V., these objections are not relevant.

281. Moreover, Section IV. notes Google's Deceptive Conduct towards publishers also extends to the Alchemist.

282. The Milgrom Report also appears to excuse Google's Deceptive Conduct by claiming "Confidentiality About Bidding Practices Is Standard, Benefited Google's Customers, and Did Not Impede Competition."[390] In Section VII., I opine that Project Bernanke is an auction modification rather than a bidding strategy, and repeat my claim that Google's "confidentiality" about Project Bernanke deceived rather than benefited Google's customers. I therefore do not find this excuse for Google's Deceptive Conduct to be persuasive.

283. The Wiggins Report states "Mr. Andrien's and Professor Weinberg's theory wrongly assumes that Google Ads advertisers commonly bid on a CPM basis, ████████████████████ ████████████████████████████████████████ bid on a CPC or CPA basis. Those advertisers relied on Google Ads to convert those bids into CPM bids that AdX could compare to CPM bids from other buyers, and Bernanke did not change that."[391]

284. This is a misunderstanding of the Weinberg Opening Report. An advertiser bidding on a CPC or CPA basis can still shade their bids, and such bidders would still benefit from bid-shading (i.e., lowering their value-per-click or value-per-action reported) into GDN.

285. The Wiggins Report further states "It is far more likely that, if Bernanke had been disclosed, Google Ads advertisers would have continued to rely on Google Ads to formulate optimal bids into AdX for them in the same way that they did in the actual world."[392]

---

[390] Expert Report of P. Milgrom, Section IV.D.6.

[391] Expert Report of S. Wiggins, ¶227.

[392] Expert Report of S. Wiggins, ¶227.

286. This response *only* claims that an uninformative text "disclosure" would not influence advertiser behavior. This argument does not address how advertisers or publishers would have behaved if Project Bernanke were transparently disclosed.

287. Moreover, this point *reinforces* that GDN advertisers "rely on Google Ads to formulate optimal bids into AdX for them." But Google Ads *does not formulate optimal bids into AdX for them* under Project Bernanke.[393]

288. Because I find Google's experts responses irrelevant and unpersuasive, I maintain this opinion.

289. "Projects Bernanke and Global Bernanke[394] did not benefit GDN advertisers but decreased win rates for advertisers using non-Google ad buying tools."[395]

290. The Baye Report states "Internal Google studies indicate that the Bernanke programs benefitted advertisers. Prior to Bernanke's launch in November 2013, experimental studies showed that as a result of Bernanke, Google Ads' ability to clear publisher reserve prices improved, ▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇▇. An intermediate launch study also showed increases in conversion ▇▇▇▇▇▇▇▇ Roughly a year and a half after launch, Google assessed that Bernanke was responsible for increasing its advertisers' win rate ▇▇▇▇▇▇ Internal studies also found that Global Bernanke increased win rates for advertisers."[396] However, the Baye Report fails to acknowledge that any increased win rates for GDN advertisers *are impressions where a GDN advertiser pays their value, which do not benefit GDN advertisers*. Therefore, the evidence of increased match/win rate does not support that "the Bernanke programs benefitted advertisers."

291. Otherwise, Google's experts again contest this conclusion *only* by contesting the Weinberg Framework.[397] Google's experts do *not* contest that these conclusions hold in the Weinberg Framework. As I maintain my opinion that the Weinberg Framework is significantly more

---

[393] During periods where Project Bernanke used a first-price payment rule.

[394] During periods when Global Bernanke used a first-price payment rule.

[395] Expert Report of M. Weinberg, Section VIII.E.1.

[396] Expert Report of M. Baye, ¶614.

[397] Professor Milgrom's report also claims that the decreased win rates for non-GDN advertisers is irrelevant because Project Bernanke is competitive, but does not contest the conclusions themselves. I do not have an opinion on what constitutes competitive or anticompetitive conduct.

justified than the Milgrom Framework, as discussed in Section V. these objections are not relevant or persuasive and I maintain this conclusion.

292. "Project Global Bernanke led to revenue reduction in some publishers."[398]

293. Professor Milgrom's report contests this claim primarily by observing that Global Bernanke improved publishers' revenue overall.[399] These conclusions do not contradict one another, so this does not change my opinion.

294. "Projects Bernanke and Global Bernanke can lead to a reduction in ad quality as well as revenue per mille for publishers."[400]

295. The Milgrom Report does not appear to explicitly object to this opinion either, and I continue to hold this opinion.

296. "Under Projects Bernanke and Global Bernanke, GDN increased its revenue at the expense of non-Google ad buying tools."[401]

297. "When combined with (Enhanced) Dynamic Allocation, Projects Bernanke and Global Bernanke enabled AdX to have a higher win rate, which would cause other exchanges to have a lower win rate."[402]

298. The Milgrom Report does not object to the substance of these claims, but objects to their relevance.[403] I do not have an opinion on what constitutes competitive versus anticompetitive conduct, and note in Section VI. that Professor Milgrom provides no convincing evidence that

---

[398] Expert Report of M. Weinberg, Section VIII.C.1.

[399] *See* Expert Report of P. Milgrom, ¶164 ("

[400] Expert Report of M. Weinberg, Section VIII.C.2.

[401] Expert Report of M. Weinberg, Section VIII.D.1.

[402] Expert Report of M. Weinberg, ¶262.

[403] *See* Expert Report of P. Milgrom, ¶167 ("Plaintiffs' experts repeatedly claim that Bernanke disadvantaged non-Google ad buying tools, but these claims conflate harms to competition with effects on competitors. Other ad buying tools could and did implement bidding strategies with similar effects as Bernanke, by reducing or omitting the second-highest bid in a second-price auction or by increasing the highest bid.")

the cited programs are in fact similar to Bernanke. I therefore continue to hold these opinions as well.

## VIII. APPLYING FIRST PRINCIPLES OF AUCTION THEORY, OPINIONS OF GOOGLE'S EXPERTS' REGARDING DYNAMIC ALLOCATION ARE INCORRECT.

299. After careful review of Google's experts' rebuttals, I still maintain all opinions in the Weinberg Opening Report concerning Dynamic Allocation. This section responds to the Milgrom Report's critiques of the Weinberg Opening Report pertaining to Dynamic Allocation as follows.

300. First, contrary to the Milgrom Report's claims, the Weinberg Framework is most appropriate to evaluate Dynamic Allocation's impact, as I discussed in above and discuss in further detail below.

301. Second, most of the Milgrom Report's rebuttals are a strawman. The Weinberg Opening Report draws conclusions regarding *the particular mechanics of Google's Dynamic Allocation*. The Milgrom Report seems to ignore this, and instead touts the benefits of *introducing real-time bidding at all*. As such the Milgrom Report does not substantively address any of the arguments in the Weinberg Opening Report.

302. Third, this section addresses three specific claims of the Milgrom Report that do not fall under the first two categories.

303. Finally, this section concludes by reaffirming the following opinions from the Weinberg Opening Report.

> i. **"Dynamic Allocation led to higher win rate and higher revenue for AdX as well as lower win rate and lower revenue for non-Google exchanges."**[404]
>
> ii. **"[I]f AdX typically transacts ads of lower quality than non-Google exchanges, Dynamic Allocation also led to an increase in the display of lower quality ads."**[405]

---

[404] Expert Report of M. Weinberg, ¶12. a.

[405] Expert Report of M. Weinberg, ¶120.

    **iii.** **"Dynamic Allocation enabled AdX to learn the header bidding clearing price."**[406]

    **iv.** **"Dynamic Allocation enabled AdX to win impressions by bidding one cent above the header bidding clearing price."**[407]

    **v.** **Dynamic Allocation restricts publisher choice when other exchanges participate in the waterfall, because "(a) AdX is always visited first in the waterfall, and (b) AdX's reserve may be increased"** [408] **due to Dynamic Allocation.**

### A.      Dynamic Allocation's impact should be evaluated according to the Weinberg Framework.

304. The Weinberg Opening Report evaluated Dynamic Allocation's impact according to the Weinberg Framework– focusing on the fact that "default" publishers set Value CPMs, according to Google's description, as the "amount you specify to help Google Ad Manager estimate the value of campaigns."[409] The Milgrom Report contests this analysis and claims a proper analysis should instead use the Milgrom Framework– focusing on "sophisticated" publishers who optimize Value CPMs as price-setting tools.

305. As established in Section V., the Weinberg Framework is more justified than the Milgrom Framework under well-accepted principles of Auction Theory and as a matter of fact. There is no reason to limit the evaluation of Dynamic Allocation, or any of Google's Deceptive Conducts, to only a subset of affected industry participants. Further, doing so skews the impacts of Google's Deceptive Conduct by excluding a majority of affected participants who may also be the participants most significantly affected.[410] Therefore, any rebuttals by Google's experts,

---

[406] Expert Report of M. Weinberg, Section IV.B.2.a.

[407] Expert Report of M. Weinberg, Section IV.B.2.b.

[408] Expert Report of M. Weinberg, ¶121.

[409] *See* Google Ad Manager Help Center, "Value CPM." Found at:
https://web.archive.org/web/20221202071803/https://support.google.com/admanager/answer/177222?hl=en

[410] Testimony in this case supports that "publishers who are less sophisticated would not have the same knowledge or level of knowledge" as sophisticated publishers with respect to Dynamic Allocation. *See* Deposition of ███████████
███████████ May 23, 2024, at 157:20-158:20 ("Q:Did they specifically discuss how they knew about dynamic allocation? A:Oh, I mean, we would often tell them all the details. Like here's how this works and, you know, and then they would -- they had various sophisticated engineers and they would also build stuff. They had -- some of their stuff was better than we had in terms of user information and targeting and things, yeah, it was kind of like a collaboration. Q:And you said ███████████ more sophisticated than other publishers? A:Yes. Q:So other

including those of the Milgrom Report regarding Dynamic Allocation, that contest conclusions of the Weinberg Report solely on the basis of contesting the Weinberg Framework basis are incorrect. I turn next to the strawman arguments presented in the Milgrom Report.

**B.      The Milgrom Report misunderstands the Weinberg Opening Report and presents a strawman argument focused on real-time bidding that does not address my analysis.**

306.    The Milgrom Report's section on Dynamic Allocation makes several claims such as: "Compared to the *status quo ante*, DA allowed real-time competition among advertisers, and according to Google's analysis it *more than doubled* publishers' revenues on non-guaranteed impressions won by AdX."[411] The Weinberg Opening Report and Weinberg Rebuttal Report do not object to claims like these that tout the benefits of real-time bidding, and there is a section in the Weinberg Opening Report dedicated to this.[412] However, these claims *do not at all address* any of the arguments regarding DA in the Weinberg Opening Report– this is precisely why the Weinberg Opening Report separated Dynamic Allocation into two sections: one with static line items (which did not raise arguments),[413] and one where line items are other exchanges (which raised arguments).

307.    The Milgrom Report mistakenly uses claims regarding the benefits of real-time bidding to address the Weinberg Opening Report's claims regarding Google's actual Deceptive Conduct and decision-making in its implementation of DA. For example, The Milgrom Report claims: "Contrary to Professor Weinberg's conclusion that DA 'led to […] a lower win rate and lower revenue for non-Google exchanges,' some of the benefits of real-time bidding can accrue to

---

publishers who are less sophisticated would not have the same knowledge or level of knowledge ▓▓▓▓▓▓▓▓▓▓▓ A:Right. They would rely on Google software instead of building their own software. And they wouldn't really have people who like went deep into here's how, you know, great, you got this RPO idea, but we can do even better with our other type of optimization. ▓▓▓▓▓▓▓▓▓▓▓▓▓▓ they're really smart to come up with stuff. Q:So they were aware of more than other publishers were aware? A:Yeah. I think, yeah. They're more professional from an engineering ad ecosystem point of view.")

[411] Expert Report of P. Milgrom, ¶295.

[412] *See* Expert Report of M. Weinberg, Section IV.A.1.

[413] Other than an observation that the default reserve set by DA on AdX is lower than optimal (because it is equal to the opportunity cost rather than exceeding it.)

non-Google demand sources,"[414] and then follows this claim with an example of a non-Google *static demand source* benefiting from the introduction of real-time bidding.[415]

308. This demonstrates a gross misunderstanding of the Weinberg Opening Report, which explicitly separated DA with static vs. live non-Google demand sources and draws all conclusions regarding DA with live non-Google demand sources. The Weinberg Opening Report makes no claims about DA with static demand sources, so nothing is or can be "contrary" to its (non-existent) conclusions about DA with static demand sources.

309. Moreover, this claim makes a "bait-and-switch" and attempts to equate DA with real-time bidding when the two technologies are distinct. It is fully consistent that the concept of real-time bidding benefits many parties, while the particular integration of real-time bidding through Dynamic Allocation with live demand sources has negative consequences.

310. To repeat this distinction:

    **i.** **Dynamic Allocation with Static Line Items integrates real-time bidding through AdX, when all other demand sources are static. The Weinberg Opening Report clearly describes this and does not argue that this implementation of Dynamic Allocation is problematic. The Milgrom Report's response primarily discusses this setting, while simply referring to it as "DA" and obscuring the distinction when other demand sources are static or live. Thus, the Milgrom Report refrains from addressing head-on the problems actually identified in the Weinberg Opening Report.**

    **ii.** **Dynamic Allocation with Live Line Items is a particular auction format among many live demand sources.**

    **iii.** **If other exchanges are integrated in the Waterfall, Dynamic Allocation *causes AdX to always be called first, but with the highest reserve*. If other exchanges are integrated via header bidding, Dynamic Allocation *gives AdX its Last Look advantage*.**

---

[414] Expert Report of P. Milgrom, ¶276.

[415] Expert Report of P. Milgrom, ¶276 ("To show that, consider the following modification of the previous example. Suppose that Network X continues to offer […]")

iv. **Real-time bidding is a concept that allows ad servers to solicit live bids for inventory. The concept is present in Dynamic Allocation with Static Line Items and Dynamic Allocation with Live Line Items and could also be implemented in numerous other potential auction formats.**[416]

311. All of the conclusions in the Weinberg Opening Report concern Dynamic Allocation with Live Line Items and draw from the particular auction format Dynamic Allocation induces.

312. None of these conclusions are remotely addressed by the Milgrom Report's claims about the benefits of real-time bidding. The Milgrom Report's arguments create a "strawman" by incorrectly implying that the Weinberg Opening Report raised arguments about real time bidding as a general concept. However, the Weinberg Opening Report does not controvert the benefits of the development of real-time bidding, instead it focuses on the impacts of Google's actual Deceptive Conduct- the implementation and application of DA in auctions with Live Line Items from other exchanges. Thus, the Milgrom Report's suggestion that the benefits of real-time bidding rebut the Weinberg Opening Report's arguments about the impacts of DA is a strawman argument. The Milgrom Report otherwise fails to address the problems with Dynamic Allocation with Live Line Items outlined in the Weinberg Opening Report, specifically:

i. **When other exchanges are integrated in the Waterfall, AdX always goes first (but with the highest reserve) which restricts publisher choice (from setting the order and reserves how they please) and preferences AdX on certain impressions;**[417] **and,**

ii. **When other exchanges are integrated via Header Bidding, AdX has a Last Look advantage which preferences AdX on all impressions.**[418]

---

[416] For example, Exchange Bidding, the Unified First Price Auction, etc.

[417] Expert Report of M. Weinberg, ¶122 ("In this case, Dynamic Allocation has the following effect as compared to no Dynamic Allocation: (a) AdX is always visited first in the waterfall, and (b) AdX's reserve may be increased.")

[418] For "default" publishers – as noted in my opening report, this does not necessarily hold for "sophisticated" publishers who boost header bids into AdX's reserve.

313. The Milgrom Report addresses these claims only by claiming that the Weinberg Framework is "unreliable" and that AdX's Last Look advantage does not necessarily exist under the Milgrom Framework, which as stated above and further discussed below, is flawed.[419]

314. Again, the more appropriate framework is the Weinberg Framework. The Weinberg Opening Report focuses on the auction mechanics induced by Dynamic Allocation and it explicitly compares those realities to counterfactuals such as:

    **i.** **What if publishers could set any Waterfall order among live demand sources, instead of always putting AdX first?**[420]

    **ii.** **What if all live demand sources participated in Header Bidding, instead of AdX having a Last Look advantage?**[421]

    **iii.** **These are the counterfactuals that isolate the impact of Dynamic Allocation's precise auction mechanics.**

315. The Milgrom Report instead focuses on misleading and irrelevant counterfactuals such as:

    **i.** **What if there were no real-time bidding at all?**[422] **This counterfactual isolates the impact of real-time bidding, rather than DA's particular auction mechanics.**

    **ii.** **What if AdX were not called at all?**[423] **This counterfactual isolates the impact of *adding a new demand source*, rather than DA's particular auction mechanics.**

---

[419] Specifically, the Milgrom Report notes that "Publishers could maximize their revenues by inflating the header bids that they submit to AdX (that is, triggering a line item with a higher value CPM than the winning header bid), leading to higher floor prices on AdX." Expert Report of P. Milgrom, ¶354.b. I *agree* that publishers *could* maximizes their revenues by inflating the header bids that they submit to AdX. I *disagree* that there is any evidence of this behavior being widespread. The Milgrom Framework posits that all publishers would inflate header bids submitted to AdX because it would increase their revenue, even though Google did not transparently describe Value CPMs as being used for this purpose. The Weinberg Framework posits instead that publishers would not inflate header bids submitted to AdX because they would set Value CPMs as per Google's suggested text and formula. Therefore, this disagreement is entirely about the Weinberg versus Milgrom Framework.

[420] Expert Report of M. Weinberg, Section IV.B.1.

[421] Expert Report of M. Weinberg, Section IV.B.1.

[422] For example, Expert Report of P. Milgrom, ¶275.

[423] Expert Report of P. Milgrom, ¶288.a ("*Counterfactual 1:* In the first counterfactual, I compare calling AdX with DA to a baseline in which the waterfall would *only* call non-Google demand sources. In this counterfactual, enabling DA brings AdX as a new source of demand for publishers.")

iii. **What if AdX were called alongside other exchanges, but not as an auction?**[424] [425] **I *agree* with Professor Milgrom's report that this isolates the impact of "auction-based pricing" (where a live demand source might pay more than the price floor if, for example, it has two live advertisers whose values exceed the price floor) as opposed to "posted-pricing" (where a live demand source never pays more than the reserve).**[426]

316. None of these counterfactuals address the auction mechanics induced by Dynamic Allocation, and so none of these claims are relevant. The first two counterfactuals are particularly irrelevant, as they simply highlight undisputed facts (that live auctions improve over static pricing and increased demand is better than less demand). In sum, the counterfactuals analyzed in the Milgrom Report do not address my conclusions, much less change them.

### C. Specific Rebuttals of the Milgrom Report.

317. In this section, I address certain rebuttals made by the Milgrom Report beyond the strawman argument focusing on real-time bidding rather than Google's actual Deceptive Conduct in implementing DA. Specifically, I opine that (1) the Milgrom Report selectively focuses on historical context while ignoring relevant counterfactuals when analyzing the impacts of DA, (2) the Milgrom Report mischaracterizes and quotes out of context the Weinberg Opening Report's conclusions relating to DA's impact on the AdX win rate, (3) the Milgrom Report poses four rebuttals to the Weinberg Opening Reports conclusion regarding DA's impact on AdX's win rate of high-value impressions – all four of which either do not truly address or do not contradict it.

318. The Milgrom Report claims that a simultaneous live auction was not feasible during the period that Dynamic Allocation took place, and it took Google several years to resolve the technical challenges.[427] This, the Milgrom Report claims, is relevant historical context which excusing

---

[424] Expert Report of P. Milgrom, ¶288.b ("*Counterfactual 2*: In the second counterfactual, I compare calling AdX with DA to a baseline in which the waterfall includes both AdX (not using DA) and non-Google demand sources".)

[425] The text in the Milgrom report clarifies that this is indeed Counterfactual 2 – "including AdX in the Waterfall" means setting a price on AdX – when visited, if AdX has at least one bidder exceeding that price, *pay exactly that price, even if there are multiple bidders exceeding that price*. *See* Expert Report of P. Milgrom, ¶607.

[426] *See* Expert Report of P. Milgrom, ¶288.b ("This comparison isolates the effect of DA's introduction of auction-based pricing.").

[427] Expert Report of P. Milgrom, ¶296 ("in the period that followed the introduction of DA, incorporating real-time bids from additional indirect demand channels would still have required further technological progress, including agreements on

the problems with Dynamic Allocation with Live Line Items. However, the Milgrom Report fails to consider the relevant counterfactuals.  By contrast, the Weinberg Report considers the following:

     **i.** **During periods when no simultaneous bidding technology existed (i.e. pre-header bidding, when non-Google exchanges were integrated via the Waterfall), the Weinberg Opening Report considers the counterfactual of letting the publisher set the order to visit all exchanges (including AdX) whereas Dynamic Allocation requires AdX to be visited first (with the highest reserve). The Milgrom Report never addresses this counterfactual.**

     **ii.** **During periods when Header Bidding existed, the Weinberg Report considers the counterfactual of AdX participating in Header Bidding together with other exchanges. The Milgrom Report again fails to address this counterfactual or explain why it is not reasonable.**

319. In addition to the Milgrom Report's failure to consider the counterfactuals proposed in the Weinberg Report, the Milgrom Report grossly mischaracterizes the Weinberg Opening Report's conclusions on DA's impact on AdX win rate. Below is first a quote from the Milgrom Report, and subsequently the conclusions from the Weinberg Opening Report.

320. "Professor Weinberg acknowledges that DA has two opposing effects on the AdX win-rate—namely, that '(a) AdX is always visited first in the waterfall, and (b) AdX's reserve may be increased.' Despite this recognition, he reaches the unwarranted conclusion that DA 'led to [a] higher win rate [...] for AdX,' even though it is well understood that these opposing effects can result in a *lower* win rate for AdX."[428]

321. Here, the Milgrom Report objects to the Weinberg Opening Report concluding that DA "led to [a] higher win rate […] for AdX"[429] when other exchanges are integrated in the waterfall. However, the Weinberg Opening Report made no such claim – this is a mischaracterization of the Weinberg Opening Report's actual claims, which are repeated below.

---

applicable industry standards. When DA was introduced, ad exchanges were still nascent and the technology standard for real-time bidding had not yet been developed".)

[428] Expert Report of P. Milgrom, ¶310.

[429] Expert Report of M. Weinberg, ¶120.

322.  "In my opinion, Dynamic Allocation led to higher win rate and higher revenue for AdX as well as lower win rate and lower revenue for non-Google exchanges. […] *This is my opinion in aggregate*, accounting for the possibility that some publishers chose to use default options while others chose to cleverly set Value CPMs to optimize revenue, **and accounting for periods both when other exchanges participated via the waterfall and when other exchanges participated via header bidding. In the subsections below, I draw more precise conclusions for each of these settings.**" (*emphasis added*)[430]

323.  This is the quote from which the Milgrom Report misleadingly pulls. In the full quote, the Weinberg Opening Report *clearly* discusses an aggregate opinion and *explicitly* roadmaps an opinion that will address the Waterfall setting in isolation. Indeed, the Weinberg Opening Report directly addresses the impact of DA on AdX's win rate when other exchanges are integrated in the waterfall:

324.  "When other exchanges primarily participate via the waterfall, Dynamic Allocation, no matter how a publisher sets Value CPMs, would lead to AdX winning an even greater volume of high-value impressions, and increased revenues from these impressions under Dynamic Allocation compared to no Dynamic Allocation."[431] And later: "The impact on 'typical-value' impressions is less clear-cut. On one hand, under Dynamic Allocation, AdX has the ability to make *all* impressions available first, meaning that AdX will always get an opportunity to solicit bids. On the other, Dynamic Allocation results in a higher reserve on AdX than without Dynamic Allocation, and so AdX's solicited bids are less likely to clear its reserve."[432]

325.  In summary:

    i.  **The Milgrom Report's rebuttal point is already explicitly addressed in the Weinberg Opening Report. The Weinberg Opening Report has already considered this point when drawing a conclusion in aggregate.**

    ii.  **The Milgrom Report mischaracterizes the Weinberg Opening Report's conclusions when raising this concern.**

---

[430] Expert Report of M. Weinberg, ¶120.

[431] Expert Report of M. Weinberg, ¶123.

[432] Expert Report of M. Weinberg, ¶124.

326. The Weinberg Opening Report states that "high-value" impressions, … have relatively high value given the fine-grained targeting data available to live bidders, but cannot be recognized as such merely on the basis of coarse targeting data used to set static reserves. When other exchanges primarily participate via the waterfall, Dynamic Allocation, no matter how a publisher sets Value CPMs, would lead to AdX winning an even greater volume of high-value impressions, and increased revenues from these impressions under Dynamic Allocation compared to no Dynamic Allocation."[433] The Milgrom Report purports to provide four objections to this claim – all of which either do not truly address or do not contradict it.

327. First, the Milgrom Report objects on the basis that "high-value" impressions are not relevant.[434] This does not address the substance or correctness of the Weinberg Opening Report's claim, but only the relevance of conclusions one might hope to draw from it.

328. Moreover, even in doing this, the objection grossly misapplies the quote from the Weinberg Opening Report about bidders having heterogeneous values. It is fully consistent with the independent values model that advertisers will have independent values equally likely to be anywhere in [10,20] for some high-value impressions, and equally likely to be anywhere in [1,2] for some low-value impressions.

329. Second, the Milgrom Report objects that the Weinberg Opening Report does not directly draw conclusions of anticompetitive conduct.[435] This is correct – I am an auction theorist, and I therefore did not opine on the anticompetitive effects of Dynamic Allocation.

---

[433] Expert Report of M. Weinberg, ¶123.

[434] "First, Professor Weinberg's example describes an atypical case in which all advertisers have high values for the same impression. In the more typical case, as acknowledged by Professor Weinberg, bidders have heterogeneous values for an impression." Expert Report of P. Milgrom, ¶314.

[435] "Professor Weinberg's claims focus on the effects on competitors, rather than the effects on competition. After claiming that DA "would lead to AdX winning an even greater volume of high-value impressions" he does not elaborate as to how that would damage Google's own publisher-customers or advertisers or the functioning of the wider marketplace." Expert Report of P. Milgrom, ¶316.

330. Third, the Milgrom Report objects that "volume of transactions" is not a relevant measure and proposes to instead focus on revenue from transactions.[436] Yet, the Milgrom Report itself highlights both measures as relevant.[437]

331. Fourth, The Milgrom Report objects to the concept of a "high-value" impression on the basis that publishers have access to "rich targeting criteria [...] including 'Custom targeting" when setting Value CPMs.[438] Like the Milgrom Report's first objection, this does not address the substance or correctness of the Weinberg Opening Report's claim, but only the relevance of conclusions one might hope to draw from it.

332. Even so, I disagree with the Milgrom Report's argument. It remains the case that AdX advertisers have access to richer user information (such as third-party cookies),[439] while Value CPMs are set based on coarser user information (i.e., only what is available through ad server functionality). A "high-value" impression is any impression for which the richer user information suggests the value is higher than the coarser user information alone would predict.[440]

---

[436] "Even Professor Weinberg's conclusion that "other demand sources necessarily win a lower volume of these high-value impressions" focuses on the wrong measure. He assesses the average value of the impressions won to measure impacts on non-Google demand sources, rather than the demand source's total surplus. Even if DA reduced the average value of impressions that a third-party demand source won, that demand source's total surplus might have increased if it transacted more impressions or faced lower floor prices due to its later position. As I demonstrated in an earlier example (see Paragraph 275), DA could make non-Google demand sources better off by increasing the volume and average value of impressions they would win." Expert Report of P. Milgrom, ¶317.

[437] *See* Expert Report of P. Milgrom, ¶262 ("In my simulations, DA also **expanded output by reducing the number of unsold impressions**."*(emphasis added)*); ¶15.f. ("EDA also **expanded output by reducing the number of unsold impressions** and helped advertisers to win the impressions they valued most."*(emphasis added)*);¶15.i. ("Sell-side DRS also **expanded output by reducing the number of unsold impressions**, allowing advertisers to win more inventory.")

[438] "Professor Weinberg suggests that publishers cannot use floor prices to effectively mitigate the issue in his example because "[AdX's] static reserve price is set based only on coarse targeting data [...]." But Google Ad Manager does allow publishers to include rich targeting criteria in their line items, including "Custom targeting" that would permit the publisher to integrate live information about the end user's recent interactions with its website." Expert Report of P. Milgrom, ¶315.

[439] *See, e.g.,* GOOG-AT-MDL-B-005180778, at -781. Jan. 27, 2023. ███████████████████ ██████████████████████████████████████████████████████████████████ ███████); GOOG-NE-13379438, at -441. Aug. 21, 2016. "Google data for DRX." ("Google data is our biggest asset, and every strategy makes use of it.").

[440] *See* GOOG-DOJ-14365517, at -517. March 2013. "Google as an AdX data provider." ("[D]ata can substantially increase per transaction."); GOOG-DOJ-14421383 at, -383. February 5, 2018. ████████████████████████████████ █████████████████████████████████████████████████████████████████████████ ███████████████████████████████████████████████████████████████████████ ████████████████████████████████████████████████████████████████████ ██████████████████████████████████████████████████████████")

333. Moreover, the Milgrom Report's argument states that RPO is one means by which AdX reserves would incorporate rich user information, but GDN is exempt from RPO,[441] so this argument does not apply to transactions where GDN is the source of "high-value."

334. Finally, the Milgrom Report proposes that a publisher could "still raise the AdX floor price to offset any expected informational advantage that a bidder on AdX might have."[442]

335. This argument misunderstands the definition of a "high-value" impression and is therefore not relevant. Indeed, "high-value" impressions are *exactly* those whose value is higher due to the rich information (i.e. third-party cookies) available to AdX bidders than would be estimated based on the coarser information available through ad server functionality, *even if the publisher inflates floor prices based on this coarser information*.

336. Indeed, the Weinberg Opening Report already addresses this claim: "no matter how publishers set Value CPMs, they are still static."[443] That is, even if publishers inflate Value CPMs, those inflated Value CPMs are still set based on the same coarser information available through ad server functionality.

337. Therefore, I maintain the opinions of the Weinberg Opening Report as stated.

   **D.    Reaffirming my Opinions concerning Dynamic Allocation.**

338. In this section, I summarize and reaffirm my opinions as stated in the Weinberg Opening Report. I maintain each of these opinions despite any of Google's experts' purported challenges to them, although I note that many of them remain unaddressed or uncontradicted by Google's experts.

339. "Dynamic Allocation led to higher win rate and higher revenue for AdX as well as lower win rate and lower revenue for non-Google exchanges."[444]

---

[441] *See* Expert Report of P. Milgrom, ¶402; *See also* GOOG-DOJ-14030931, at -931 ("Previously in second price AdX auctions, Adwords was exempt from RPO floor.").

[442] Expert Report of P. Milgrom, ¶315.

[443] Expert Report of M. Weinberg, ¶123.

[444] Expert Report of M. Weinberg, ¶12.a.

340. The Milgrom Report objects to this claim first by grossly mischaracterizing it, and then by repeating a claim that the Weinberg Opening Report has already responded to. This is addressed thoroughly in Section VI. I therefore maintain this opinion.

341. "[I]f AdX typically transacts ads of lower quality than non-Google exchanges, Dynamic Allocation also led to an increase in the display of lower quality ads."[445]

342. The Milgrom Report objects to this claim by objecting to the use of the word "if" in the Weinberg Opening Report.[446] Although others of the Plaintiff's experts opine on this topic, neither the Weinberg Opening Report or this Report contain an opinion on whether AdX typically transacts ads of lower quality than non-Google exchanges. The Weinberg Opening Report does contain an opinion on how the auction mechanics of DA would impact outcomes if the converse were to be true.

343. The Milgrom Report further objects that publishers who are sensitive to ad quality "could control the average ad quality in several ways, including by increasing the floor price applying to AdX."[447] This argument is irrelevant to the conclusions of the Weinberg Opening Report. Indeed, publishers can increase the floor price applying to AdX with or without Dynamic Allocation. Therefore, the Milgrom Report's argument does not address the *marginal* change in ad quality due to Dynamic Allocation. My opinion is that the *marginal* change in ad quality due to Dynamic Allocation would be negative and is fully consistent with the publisher having other tools at their disposal to improve ad quality (including an increase to AdX's price floor).

344. Because both of the Milgrom Report's rebuttals are irrelevant to the conclusions in the Weinberg Opening Report, I maintain this opinion.

---

[445] Expert Report of M. Weinberg, ¶120.

[446] *See* Expert Report of P. Milgrom, ¶311 ("Professor Weinberg reasons that, "*[i]f* it is the case that AdX typically transacts ads that are of lower quality compared to non-Google Exchanges," then DA "would result in lower quality ads displayed on high-value impressions [...]." Professor Weinberg does not provide evidence that ad quality differences between AdX and third-party demand sources were in fact common or significant.").

[447] Expert Report of P. Milgrom, ¶311. Professor Milgrom does not give any examples of the other ways – only increasing price floors.

"Dynamic Allocation enabled AdX to learn the header bidding clearing price," [448] and "Dynamic Allocation enabled AdX to win impressions by bidding one cent above the header bidding clearing price."[449]

345. The Milgrom Report objects to these two claims *only* by objecting to the Weinberg Framework.[450] The Milgrom Report raises *no objections* to the logic deriving these conclusions in the Weinberg Framework. As discussed in Sections V. and X., the Weinberg Framework is significantly better justified, even when only considering the evidence in the Milgrom Report in isolation. I therefore maintain this opinion.

346. Dynamic Allocation restricts publisher choice when other exchanges participate in the Waterfall, because "(a) AdX is always visited first in the waterfall, and (b) AdX's reserve may be increased"[451] due to Dynamic Allocation. None of Google's experts address this claim, and I therefore maintain this opinion.

---

[448] Expert Report of M. Weinberg, Section IV.B.2.a.

[449] Expert Report of M. Weinberg, Section IV.B.2.b.

[450] The Baye Report similarly objects to these two claims by objecting to my Framework. "If a publisher preferred a non-AdX demand source, the publisher could preference that demand source by setting a high corresponding vCPM—and therefore a high price floor for AdX to beat to win an impression—making it less likely that an AdX bid would be high enough to win an impression instead of that demand source." Expert Report of M. Baye, ¶545.

[451] Expert Report of M. Weinberg, ¶121.

## IX.    APPLYING FIRST PRINCIPLES OF AUCTION THEORY, OPINIONS OF GOOGLE'S EXPERTS' REGARDING ENHANCED DYNAMIC ALLOCATION ARE INCORRECT.

347.    This section responds to Google's experts' critiques of the Weinberg Opening Report pertaining to Enhanced Dynamic Allocation. And, after careful review of Google's experts' rebuttals, I still maintain all opinions in the Weinberg Opening Report concerning Dynamic Allocation and Enhanced Dynamic Allocation.

348.    First, Section IX.A. responds to the Baye Report's arguments suggesting that EDA did not advantage AdX. I maintain my opinion that EDA advantages AdX versus non-Google exchanges.

349.    Second, Section IX.B. responds to the Milgrom Report's arguments that "cream-skimming" would *not* occur due to EDA. I maintain my opinion that "cream-skimming" would occur due to EDA and share evidence that cream-skimming did indeed occur.

350.    Third, Section IX.C. responds to the Milgrom and Baye Reports which list several non-Google programs that they claim "have a similar product feature"[452] to Enhanced Dynamic Allocation. Most all are not similar.

351.    Fourth, Section IX.D. clarifies the full context for a quote pulled from the Weinberg Opening Report which the Milgrom Report mischaracterizes.

352.    Fifth, Section IX.E. observes a mistake in (2) of Theorem 2 from the Milgrom Report.[453] This discussion first shows a simple counterexample to (2) of Theorem 2 of the Milgrom Report as currently stated. Next, the discussion shows that a common regularity assumption restores Theorem 2 of the Milgrom Report in a special case.[454]

353.    Finally, Section IX.F. concludes by reaffirming the following opinions from the Weinberg Opening Report.

---

[452] Expert Report of P. Milgrom, Table 1.

[453] *See* Expert Report of P. Milgrom, ¶328.

[454] A more convoluted assumption would be necessary to fully restore Professor Milgrom's Theorem 2, so I omit this from the report.

i.   **"Enhanced Dynamic Allocation likely led to an increase in win rate and increase in revenue for AdX."**[455]

ii.  **"[Enhanced Dynamic Allocation] reduced the value of direct deals for advertisers, which would in turn decrease the revenue earned by publishers via direct deals."**[456]

iii. **"AdX is the only exchange that unconditionally has this opportunity"**[457] **to auction "impressions that otherwise would have been reserved for high priority line items such as direct deals."**[458] **"Another exchange can have this opportunity, but [...] [there is a] high barrier to this exchange being considered in front of the high priority line item at all, [...] [and] AdX still gets a first bite."**[459]

iv.  **"If impressions that satisfy targeting criteria for direct deals are on average more valuable than impressions that do not, then Enhanced Dynamic Allocation results in more valuable transactions being transacted through AdX rather than direct deals."**[460]

A.   **Enhanced Dynamic Allocation materially preferenced AdX as compared to non-Google exchanges.**

354. The Baye Report suggests that EDA did not preference AdX because it was designed as a mechanism to increase publisher revenue.[461] But an increase in publisher revenue under EDA does not foreclose the ability of EDA to preference AdX. As the Weinberg Opening Report states, "AdX is the only exchange that unconditionally has th[e] opportunity [to run an auction for all impressions]. Under Enhanced Dynamic Allocation, another exchange can have the opportunity to run an auction for all impressions, but only if (a) its Value CPM exceeds the

---

[455] Expert Report of M. Weinberg, ¶137.

[456] Expert Report of M. Weinberg, ¶137.

[457] Expert Report of M. Weinberg, ¶140.

[458] Expert Report of M. Weinberg, ¶139.

[459] Expert Report of M. Weinberg, ¶140.

[460] Expert Report of M. Weinberg, ¶142.

[461] Expert Report of M. Baye, ¶¶531-533.

highest temporary CPM among high priority line items, and (b) AdX fails to clear its reserve. In particular, (a) suggests a high barrier to this exchange being considered in front of the high priority line item at all, and (b) notes that AdX still gets a first bite, even if the Value CPM of an exchange is high enough to satisfy (a)."[462] None of Google's experts' challenge this opinion. Thus, the Baye Report's suggestion that EDA did not preference AdX is materially unsupported.

355. The Baye Report does note, however, that when other exchanges participate via Header Bidding "[t]he highest vCPM remnant line item—which could be, for example, the highest bid from header bidding passed to the DFP server in real-time—would win the impression if it is higher than both the EDA price and the highest bid in AdX."[463] This suggests that exchanges called via header bidding are on equal footing with AdX to compete for such impressions. I disagree with this implication, and it is still my opinion that AdX is preferenced as compared to non-Google exchanges because AdX still has the Last Look advantage over exchanges integrated via Header Bidding. Thus, EDA's Last Look Advantage directly impacts impressions previously reserved for direct deals.

356. Moreover, the Baye Report's suggestion that AdX is not materially preferenced compared to non-Google exchanges fails to take into account that AdX knows the tCPM floor set by EDA when calling its advertiser, whereas exchanges integrated via Header Bidding do not.[464] The optimal bid-shading in a first-price auction is highly dependent on the reserve – exchanges integrated via Header Bidding would over-shade their bids if they believed the reserve to be lower, when actually the EDA tCPM floor will raise it.[465]

357. In summary, the Baye Report's suggestion that AdX is not preferenced by EDA because it is focused on increasing publisher revenue is misguided. As noted, the Baye Report does not take into account the Last Look advantage EDA provides with respect to direct deals. Because

---

[462] Expert Report of M. Weinberg, ¶140.

[463] Expert Report of M. Baye, ¶532.

[464] This is because the tCPM floor is computed by DFP while processing the impression and not set by the publisher. Therefore, when Header Bidding lacks this information when soliciting bids from exchanges.

[465] As a quick example to have in mind: imagine that an exchange is called via Header Bidding with a publisher-set price floor of $5, and an advertiser has a value of $10. That advertiser might shade its bid down to $8, believing this is the optimal bid above $5 to balance the probability of winning with the price paid. But if the EDA reserve is $9, this bid of $8 is immediately noncompetitive. Had the exchange known the EDA reserve, the advertiser would have instead shaded its bid to a value between $9 and $10.

of this, all my opinions expressed the Weinberg Opening Report remain unchanged. Namely, that the mechanics of EDA materially advantaged AdX as compared to non-Google exchanges when competing for impressions previously reserved for direct deals.

### B.    Cream-skimming occurred due to EDA.

358.    The Milgrom Report claims to refute the idea that Cream-Skimming occurred under EDA. Primarily, the Milgrom Report attacks the Weinberg Opening Report's hypotheticals as "unrepresentative" because it "oversimplifies the diversity of advertiser and end user interests."[466]

359.    The Weinberg Opening Report states that EDA "reduces the value of direct deals for advertisers, which would likely decrease the revenue that publishers can expect to earn via direct deals." [467] The Weinberg Opening Report demonstrates this concept of "cream-skimming" with an example of one shoe company having a direct deal, and another shoe company bidding in live auctions. Under EDA the shoe company bidding in a live auction would win the high-value "cream" leaving the shoe company with a direct deal with less valuable impressions. Importantly, this example implies that both shoe companies find the same impression to be "high-value."[468]

360.    The Milgrom Report proposes an alternate example of a shoe company having a direct deal, and an airline company bidding in live auctions.[469] EDA would cause the airline company to win what it considers to be high-value impressions, leaving the shoe company with impressions the airline company considers to be low value. Importantly, this example implies that the shoe company's value is uncorrelated with the airline company's value – the shoe company is not at all bothered to receive impressions that the airline considers to be low-value.

---

[466] Exert Report of P. Milgrom ¶ 347.

[467] Expert Report of M. Weinberg, ¶143.

[468] See Expert Report of M. Weinberg, ¶143-144.

[469] Expert Report of P. Milgrom, ¶348 ("EDA can promote better matching by allocating the ad slot to Altra or Reebok when the user is researching running shoes, to American Airlines when he'd like to fly, or to a furniture seller during a move.")

361. Additionally, the Milgrom Report contains an experiment from 2022 data. That experiment, taken at face value,[470] suggests that the cream-skimming effect was negligible during the period of considered data.

362. However, internal Google documents state cream-skimming *did* occur due to EDA. Moreover, this source of cream-skimming undermines the experiment in the Milgrom Report.

363. Specifically, Google had a program called "CTR Optimization" because "pubs want to maximize clicks on their premium inventory."[471] A Google presentation describes an online matching algorithm that decides which impressions to award to direct deals, and which to send to remnant line items, based on *predicted Click Through Rate* (pCTR). That is, CTR Optimization ensured direct deals received '"the best"' impressions (or, more accurately, that impressions were algorithmically matched in a manner to optimize pCTR across all direct deals), rather than simply '"the first"' impressions to satisfy targeting criteria during a billing period.

364. Put another way, this presentation contradicts the Milgrom Report's claims that "[p]rior to Google's introduction of Enhanced Dynamic Allocation, if an impression met the eligibility criteria for one or more guaranteed contracts, **it would be immediately assigned to one of those**,"[472] (emphasis added) and "[u]nder EDA, guaranteed contracts are still fulfilled, but **remnant demand is no longer eligible to purchase an arbitrary selection of impressions**— just those for which it is willing to pay most."[473] (emphasis added) The first claim is false due to CTR Optimization, and the second mistakenly claims that remnant demand purchase an 'arbitrary' selection of impressions pre-EDA.

365. Importantly, the existence of CTR Optimization also contradicts the "null hypothesis" of the experiment in the Milgrom Report. Specifically, the Milgrom Report compares "Field #1: The average value of the predicted-engagement metric over all impressions that would be eligible to fulfill the guaranteed contract"[474] to "Field #2: The average value of the predicted-

---

[470] Later in this section, I offer a reason not to take this experiment at face value. *See* Section VI. for several other reasons not to take claims in the Milgrom Report at face value.

[471] GOOG-NE-06828586, at -91.

[472] Expert Report of P. Milgrom, ¶323.

[473] Expert Report of P. Milgrom, ¶329.

[474] Expert Report of P. Milgrom, ¶338. a.

engagement metric over the impressions allocated to the guaranteed contract."[475] Moreover, the Milgrom Report states "I treat Field #1 as a measure of impression quality in a counterfactual "without EDA" scenario. I expect Field #1 (which contains the average value of the predicted-engagement metric over all eligible impressions) to be equal to the average value of that metric over impressions assigned to guaranteed contracts without EDA. **The reason is that, before EDA, the impressions assigned to guaranteed contracts were the first eligible impressions to arrive in the relevant time period** and, in terms of ad quality, I have no reason to believe that those impressions differ systematically from an average impression."[476] (emphasis added). In particular, this demonstrates that the Milgrom Report incorrectly uses "no-EDA **and no-CTR Optimization**" as its counterfactual for "no-EDA", and compares this to "yes-EDA, yes-CTR Optimization." A more relevant counterfactual would be "no-EDA**, yes CTR Optimization**."

366. Therefore, taking the experiment in the Milgrom Report at face value, it merely shows no change in impression quality between a world with both EDA (risks cream-skimming harm to direct deals) and CTR Optimization (improves pCTR for direct deals) versus an irrelevant counterfactual of no EDA and no CTR Optimization. In particular, the Milgrom Report gives EDA the pCTR benefits of CTR Optimization but omits the same benefits from the no-EDA counterfactual.[477]

367. Finally, the experiment in the Milgrom Report contains data from 2022, eight years after the introduction of EDA. In fact, between the launch of EDA and 2022 Google launched a revised EDA to better interact with CTR Optimization.[478]

368. In addition, if EDA indeed resulted in cream-skimming and reduced the value of direct deals, as it in fact did, then advertisers vulnerable to cream-skimming may have done any of the following by 2022: (a) exit the direct deals market, (b) invest less heavily in direct deals, or (c) modify the targeting criteria in their direct deals to mitigate cream-skimming.

---

[475] Expert Report of P. Milgrom, ¶338. b.

[476] Expert Report of P. Milgrom, ¶339.

[477] A more relevant experiment would have compared EDA and CTR Optimization to no-EDA but yes-CTR Optimization. Another relevant experiment would have compared EDA but no-CTR Optimization to no-EDA and no-CTR Optimization. The problem with the Milgrom Report's experiment is that it gives only EDA the benefit of CTR Optimization, but not the no-EDA counterfactual.

[478] *See* GOOG-DOJ-AT-02368104 at -04 ("We have launched EDA with CTR Opt.")

369.  Therefore, even if one were to take the experiment in the Milgrom Report at face value, one would expect an experiment on 2022 data to understate the impact of cream-skimming closer to the launch of EDA.

370.  Moreover, Google documents clearly provide evidence of cream-skimming.

371.  ███████████████████████████████████████████████

███████████████████████████████████████████████

████

█████████████████████████████████████████████████

███████████████████████████████████████████ ██ ██

███████████████████████████████████████████████

████████████ ████

█████████████████████████████████████████████████

████████████████████████████████████████ ██ ████

████████████████████████████████ **483**

b.  ███████████████████████████████████████████████

█████████████████████████████████████████████ The document suggests
they "consider turning off EDA until joint optimization is ready." [484]

c.  ███████████████████████████████████████████████

███████████████████████████████ [485] [486] The document suggests "These
are likely those with highly correlated AdX/remnant impressions value and impression pCTR. This

---

[479] GOOG-DOJ-14140113.

[480] GOOG-DOJ-14140113 at -13.

[481] GOOG-DOJ-14140113 at -13.

[482] GOOG-DOJ-14140113 at -13.

[483] GOOG-DOJ-14140113 at -13.

[484] GOOG-DOJ-14140113 at -14.

[485] GOOG-DOJ-14140113 at -14.

[486] The document notes that some of these had a reduced CTR to baseline just from CTR Optimization backfiring (independent of EDA.)

means their CTR Opt lift has gone negative after EDA (though they have positive revenue gains). They should consider the tradeoff between EDA revenue and clicks." [487]

d.     ████████████████████████████████████████████

██████████████████████████ [488] [489] The document suggests "These pubs should consider the tradeoff between incremental clicks from CTR Opt and the incremental revenue from EDA and decide which they value more."[490]

372.  Therefore, this document directly describes evidence of cream-skimming, and notes that it affects many publishers (including some who do not even benefit from EDA).

373.  Another document[491] describes the problem in detail. It states: "suppose AdX bids are correlated with high CTRs. Then, by assigning the impressions with the highest bids to AdX, we would be *systematically denying high-CTR impressions to reservation ads*." [492] This document further describes the "CTR Optimization with Integrated AdX" feature, which seems to have launched in 06/13/2016.[493]

374.  Lastly, a final document[494] raises this concern by email. It states: "[s]ince the release of EDA, we have identified some instances where a publisher's inventory has a high correlation between DFP CTR Optimization impressions and AdX impressions. This high correlation sometimes results in a lower CTR Opt uplift than the publisher may have seen previously to EDA. [...]

████████████████████████████████████████████

██████████████."[495]

---

[487] GOOG-DOJ-14140113 at -13.

[488] GOOG-DOJ-14140113 at -14.

[489] The document notes that the positive lift is still above baseline.

[490] GOOG-DOJ-14140113 at -14.

[491] GOOG-AT-MDL-004229707 at -07.

[492] GOOG-AT-MDL-004229707 at -07. The document next notes "Fortunately, it does not appear to be the case that AdX bids are highly correlated with CTRs. Even if they are completely uncorrelated, however, it will be the case that *some* impressions have high CTR as well as high AdX bids. ████████████████████████████████████████████ ████████████████████████████████████████████ ████████   GOOG-AT-MDL-004229707 at -07.

[493] GOOG-DOJ-AT-02368104 at -04 ("06/13/2016 […] We have launched EDA with CTR Opt.")

[494] GOOG-AT-MDL-003161451 at -51.

[495] GOOG-AT-MDL-003161451 at -51.

375. There is clear evidence of cream-skimming from Google's own documentation, and because the experiment in the Milgrom Report uses a misguided counterfactual (and because one would expect cream-skimming to be more pronounced closer to the launch of EDA than 2022 in any case), the Milgrom Report's opinion that EDA did not result in cream-skimming is misguided. Thus, I maintain the opinion stated in the Weinberg Opening Report that EDA reduces the value of direct deals for advertisers (and that this would likely decrease the revenue that publishers can expect to earn via direct deals).

**C. The Milgrom Report's and Baye Report's list of "similar" programs is not so similar.**

376. The Milgrom and Baye Reports ████████ non-Google products as using technology "similar to EDA to allocate impressions between guaranteed contracts and remnant demand."[496] The Milgrom Report further states that all of these "allocate impressions between guaranteed contracts and remnant demand."[497] However, most all are not "similar to EDA."[498]

377. To be a "similar"[499] program, there are two key features of EDA that must be present. First, the program must preference live demand sources (AdX) as compared to others. Second, the program must make direct deals vulnerable to cream-skimming and restricts publisher choice in addressing that concern.

378. There are ████████████ cited by the Milgrom Report and Baye Report which they claim are similar. ████████████████████████████████████████████████████████ ████████████████████████████████████████.[500]Those programs are evaluated against the two key properties of EDA in the discussion below. But based on a thorough review of the documents cited by the Milgrom Report and Baye Report, five███████████████████████ ██

379. ████████████████████████████████████ the cited (and surrounding) documents provide *nowhere near enough information* to conclude whether these programs share either property with EDA.

---

[496] Expert Report of P. Milgrom, ¶320.

[497] Expert Report of P. Milgrom, ¶320.

[498] Expert Report of P. Milgrom, ¶320.

[499] Expert Report of P. Milgrom, ¶320.

[500] Expert Report of P. Milgrom, Table 1.

███████████████████████████████████████████████
███████████████████████████████████████████████
███████████████████████████████████████████████
███████████████████████████████████████████████
███████████████████████████████████████████████
███████████████████████████████████████████████
███████████████████████████████████████████████
████████████████████

b.   For the case of Magnite, the Milgrom Report cites a Magnite earning call, which contains the following: "Having a tightly integrated ad server allows for the dynamic allocation of programmatic and nonprogrammatic inventory to provide a holistic yield management solution for publisher." Available at: https://investor.magnite.com/static-files/950ded3e-8953-4cf9-a043-d0e72b1fb856. This is sufficient to claim that Magnite "allocates impressions between guaranteed contracts and remnant demand," but provides absolutely no basis by which to conclude the manner by which they do so is "similar to EDA."

c.   For the case of FreeWheel, the Milgrom Report present the following information from a news article: "Comcast's FreeWheel is launching a unified decisioning capability for buyers and sellers to transact across both direct sold and programmatic advertising." Available at: https://www.streamtvinsider.com/tech/comcast-s-freewheel-launches-unified-ad-decisioning.    This article fails to establish that either of the two key features of EDA is present in FreeWheel.

380.   For Xandr, the cited (and surrounding) documents do not provide enough information to conclude whether the program preferences one live demand source over another. Moreover, the cited (and surrounding) documents transparently demonstrate significant publisher flexibility compared to EDA to decide which direct deals compete with Real-Time Bidders, which provides flexibility to address cream-skimming.[501]

381.   ████████████████████████████████████████████████
████████████████████████████████████████████████

---

[501] Xandr documentation explicitly states that "Under all these scenarios, if there is an eligible guaranteed delivery line item with: a delivery type of Exclusive and a priority greater than or equal to all other line items, that line item will be the only one selected and will win the impression." Available at: https://learn.microsoft.com/en-us/xandr/monetize/open-dynamic-allocation-and-flexible-priorities

████████████████████████████████████████████████████████████

████████████████████████████████████████████[502]

382. ███████████████████[503] is there any detail given to remotely conclude the program is "similar to EDA" in both properties.[504] [505]

383. In summary, there is only evidence to plausibly conclude ██████████████████ to both key properties of EDA. There is evidence that it can plausibly be concluded that ███████████

████████████████████████████████████████████████████████████

████████████████████████████████████████████████████████████

There is insufficient evidence to conclude whether ██████████████ share any similarities to the two key properties of EDA. Finally, Xandr's program appears to be notably dissimilar from EDA because it allows publisher flexibility to decide which direct deals compete with Real-Time Bidders, which reduces susceptibility to cream-skimming.

384. In summary, the Milgrom Report's and Baye Report's examples do not demonstrate nearly that the claimed non-Google programs are "similar to EDA."[506] In particular, the Milgrom Report conflates "allocat[ing] impressions between guaranteed contracts and remnant demand"[507] and "similar to EDA."[508] Allocating impressions between guaranteed contracts and remnant demand is a difficult challenge worth addressing, and it is therefore not at all surprising that non-Google products tackle this challenge. The *particular mechanics of EDA, Google's "solution,"* motivate the arguments in the Weinberg Opening Report surrounding EDA.

---

[502] ████████████████████████████████████████████████

████████████████████████

[503] ████████████████████████████████████

[504] ████████████████████████████████████

[505] ████████████████████████████████

[506] Expert Report of P. Milgrom, ¶320.

[507] Expert Report of P. Milgrom, ¶320.

[508] Expert Report of P. Milgrom, ¶320.

Therefore, these non-Google programs are not "similar to EDA"[509] simply because they address the same challenges.

### D.  Correcting the Milgrom Report's mischaracterization of quotes from the Weinberg Opening Report.

385.  The Milgrom Report states "[i]ndeed, by adding a floor price for non-guaranteed demand that was "informed by" the opportunity cost of not serving a guaranteed line item, EDA worked similarly to the mechanism Professor Weinberg claims he would implement if he "were to design a waterfall-like format from scratch."[510] This discussion briefly repeats the original remarks from the Weinberg Opening Report, and clarifies this opinion.

386.  The Weinberg Opening Report states: "[p]rioritization of direct deals over exchanges is a curious feature of the waterfall. If I were to design a waterfall-like format from scratch and I were unconstrained by technological challenges, I would (a) find the maximum payment $v$ I could get from a direct deal for this impression (maybe $v = 0$, if it satisfies no direct deal targeting criteria), then (b) visit exchanges in the waterfall but setting reserves informed by $v$,"[511] and later in the same footnote: "[s]till, I do not mean to imply that this curiosity has a simple resolution. Because direct deals are made with coarser targeting criteria than live ad auctions, direct deal advertisers may insist on being considered first in order to avoid becoming victims of "cream-skimming"[512] (where among impressions that satisfy the same coarse targeting criteria, live ad auctions win the "good" impressions and leave the "bad" ones for direct deals). I share this commentary primarily to give an example of how an auction theorist might reason through the process of auction design, although this particular thought process plays a role in my later analysis of Enhanced Dynamic Allocation."[513]

387.  The Milgrom Report cites the first statement in the footnote, but not the second. The full quote is repeated here to be clear that the Weinberg Opening Report by no means "endorses" EDA.[514]

---

[509] Expert Report of P. Milgrom, ¶320.

[510] Expert Report of P. Milgrom, ¶324.

[511] Expert Report of M. Weinberg, footnote 76.

[512] Expert Report of M. Weinberg, footnote 76.

[513] Expert Report of M. Weinberg, footnote 76.

[514] The Milgrom Report does not claim my opening report endorses EDA. I state this clearly to avoid potential misunderstanding of my opening report.

388. To the extent that this footnote endorses anything, it endorses a general framework of "setting prices on live demand sources that are informed by static demand sources" -- it absolutely does not endorse the particular mechanics of EDA (indeed, I take issue with the particular mechanics of EDA – both the fact that it preferences AdX, and the fact that it is careless towards cream-skimming).[515]

### E.  Theorem 2 of the Milgrom Report is mistaken.

389. Theorem 2 of the Milgrom Report is mistaken. It states: "**Theorem 2**: Suppose that publishers' guaranteed contracts are unchanged after the introduction of EDA and that Google accurately forecasts the distribution of future bids from AdX. Then (1) EDA increases the publisher's expected revenue relative to the pre-EDA allocation procedure, and (2) if publishers set the optimal floor price for the AdX auction ignoring direct contracts, the floor set by EDA maximizes publisher revenue."[516] Note that in the proof of Theorem 2, the Milgrom Report "assume[s] that $F$ is continuous and has bounded density", but does not make further assumptions.[517]

390. (2) of Theorem 2 does not hold for all F that satisfy the Milgrom Report's assumptions. Here is a simple example:

391. Let F have the following CDF, which is continuous and has bounded density:[518]

$F(x) = 0$ on [0,3]

$F(x) = 0.4*(x-3)$ on [3,4]

$F(x) = x/10$ on [4,10]

$F(x) = 1$ on [10,∞)

   a.  Let the fraction of impressions that must be reserved for the direct deal be 0.4. In the language of the Milgrom Report, q=0.4.

---

[515] The Milgrom Report does not explicitly claim the Weinberg Report endorses the particular mechanics of EDA. I repeat this point to avoid potential misunderstanding of my opinions.

[516] Expert Report of P. Milgrom, ¶328.

[517] Expert Report of P. Milgrom, ¶629. Here, F denotes the distribution of the highest AdX bid.

[518] The density is at most 0.4 everywhere.

b.　For simplicity, let there be no live competition aside from AdX. In the language of the Milgrom Report, $v = \mu = 0$.

c.　For simplicity, let AdX have only a single bidder (whose value is drawn according to F). In the language of the Milgrom report, $REV_{AdX}(a) = a$ for all a.

d.　The optimal floor price for AdX ignoring direct contracts is 3, which would yield revenue 3.[519]

392.　In the above simple example:

a.　The EDA reserve is 4 – this reserves exactly a 0.4 fraction of impressions for the direct deal, and sells the remaining 0.6 fraction to AdX at a price of 4. This results in an EDA revenue of 2.4.

b.　Alternatively, the publisher could set a reserve of 5. This reserves a 0.5 fraction of impressions for the direct deal (the additional 0.1 fraction of reserved impressions do not generate additional revenue – they go unsold) and sells the remaining 0.5 fraction to AdX at a price of 5. This results in an EDA revenue of $2.5 > 2.4$.[520]

c.　Therefore, this counterexample contradicts (2) of Theorem 2 (meaning (2) of Theorem 2 is false).

393.　(2) of Theorem 2 can be fixed, however, in the special case where AdX has only one bidder and there is no other live competition. This can be done by requiring an assumption on F. In particular, the property driving the above example is that the optimal reserve for F is 3, yet 5 is a better reserve than 4 even though 5 is further from 3 than 4. If the Milgrom Report additionally assumes that F is *regular*[521] or has *decreasing marginal revenues*,[522] (2) of Theorem 2 would be restored in this special case.

---

[519] To quickly see this, observe that any reserve r in [3,4] generates revenue r*(1-0.4*(r-3)), which is maximized on [3,4] at 3. Any reserve r in [4,10] generates revenue r*(1-r/10), which is maximized at r = 5. The revenue at r = 3 is 3, and the revenue at r = 5 is 2.5.

[520] In fact, an even better strategy would be to randomly set an EDA reserve equal to 5 with probability 0.8, and equal to 3 with probability 0.2. This would still reserve a 0.5*0.8 = 0.4 fraction of impressions for the direct deal and generates revenue 2.5*0.8 + 3*0.2 = 2.6.

[521] A distribution is regular if its associated *revenue curve*, R(q) = q*(1-F^{-1}(q)), is concave.

[522] A distribution has decreasing marginal revenues if its value-based revenue curve, V(r) = r*(1-F(r)), is concave.

a.  Indeed, observe first that EDA can only *increase* AdX's price floor, and also that EDA *must increase* AdX's price floor to at least the EDA reserve (otherwise, not enough impressions are left for the direct deal).

b.  Therefore, if r denotes AdX's optimal price floor (in absence of direct deals), and e denotes the EDA reserve, the optimal reserve for EDA to set is simply the optimal price for AdX that exceeds both r and e. EDA is optimal if and only if this optimal price is exactly the maximum of r and e.

c.  For distributions that are either regular or decreasing marginal revenues, and any x, the optimal price that exceeds both r and x is exactly the maximum of r and x.[523] Therefore, this assumption would guarantee that the EDA reserve is optimal.

394.  For the case when AdX has multiple bidders, Theorem 2 would require some joint assumption on $REV_{AdX}()$, F, μ, and v.

## F.  Reaffirming the opinions of the Weinberg Opening Report concerning Enhanced Dynamic Allocation.

395.  In this section, I summarize and reaffirm my opinions as stated in the Weinberg Opening Report. I maintain each of these opinions despite any of Google's experts' purported challenges to them, although I note that many of them remain unaddressed or uncontradicted by Google's experts.

396.  "Enhanced Dynamic Allocation likely led to an increase in win rate and increase in revenue for AdX."[524]

397.  The Milgrom Report claims "[T]he introduction of EDA benefited publishers by increasing their revenues, so any change in AdX's win rate or revenue was competition on the merits: Google won more business by providing a better service to its publisher customers."[525] It also provides a theorem in support.

---

[523] This follows from concavity of the revenue curve and value-based revenue curve.

[524] Expert Report of M. Weinberg, ¶137.

[525] Expert Report of P. Milgrom, ¶327.

398. As an auction theorist, I do not have an opinion on whether EDA is competitive or anticompetitive conduct. Moreover, as noted in Section II.E, the Milgrom Report's cited theorem is incorrect without further technical assumptions.

399. As the Milgrom Report's claim is irrelevant to the conclusions in the Weinberg Opening Report (and moreover based on a theorem that is incorrect as currently stated), I maintain this opinion.

400. "[Enhanced Dynamic Allocation] reduced the value of direct deals for advertisers, which would in turn decrease the revenue earned by publishers via direct deals."[526]

401. The Milgrom Report objects to this claim as described in Section VI., and instead opines that EDA did not reduce the value of direct deals for advertisers. Section VI. discusses why I maintain this opinion even after accounting for the Milgrom Report's arguments.

402. The Milgrom Report further states "Professor Weinberg's example omits discussion of Altra's overall display advertising strategy, which might include a combination of guaranteed and programmatic advertising. In that case, EDA would make it easier for Altra to win valuable remnant inventory (including the remarketing impression described in Professor Weinberg's example) using real-time bidding [...] As a result, EDA can increase the value of impressions won by Altra on average across direct deals and remnant campaigns."[527] This claim is irrelevant to my conclusions, as it is fully consistent for Altra to win more inventory using RTB and to find less value in direct deals. This opinion, as explicitly stated, is purely about the value of direct deals.

403. The Milgrom Report also states "[i]ndeed, if EDA increased the average revenue per impression allocated to remnant advertising, that would increase the competition for all impressions and contribute to an increase in the price of direct deals as well, which is the opposite of what Professor Weinberg's analysis implies." This proposition is irrelevant to the claim in the Weinberg Opening Report– the Milgrom Report's argument intends to claim that the *price of direct deals* would increase (due to competitive pressure). The Weinberg Opening Report's claim is that *the value of direct deals to advertisers would go down* (that is, the willingness to pay of an advertiser for direct deals would go down, which in the long run would reduce the revenue earned by direct deals, independent of competitive pressure). These two

---

[526] Expert Report of M. Weinberg, ¶137.

[527] Expert Report of P. Milgrom, ¶349.

claims are entirely consistent, and so this argument of the Milgrom Report's is irrelevant to the conclusion drawn in the Weinberg Opening Report.

404.   Thus, based on the discussion in Section II.B and the response immediately above, I maintain this opinion.

405.   "AdX is the only exchange that unconditionally has this opportunity [to auction "impressions that otherwise would have been reserved for high priority line items such as direct deals"[528]]. Another exchange can have this opportunity, but [...] [there is a] high barrier to this exchange being considered in front of the high priority line item at all, [...] [and] AdX still gets a first bite."[529]

406.   The Baye Report contains a plausible objection to this claim, which is addressed in Section III.

407.   The Baye Report further states: "In addition, once Open Bidding launched in April 2018, third-party exchanges were able to bid in real-time against AdX for "impressions." All guaranteed reservation impressions from publishers who chose to use Open Bidding were made available to third-party exchanges at the same time as AdX, and to the extent that such impressions were not sent to Open Bidding, it was due to the publisher's choice." This argument does not address the period pre-2018, where the opinion applies. Moreover, the Weinberg Opening Report states (and this report maintains, in Section XIII. that AdX and Exchange Bidding exchanges still have a Last Look advantage over Header Bidders, so the spirit of this claim continues to hold even after the introduction of Open Bidding.

408.   Because both objections in the Baye Report are addressed, and Defendant's experts otherwise do not address this claim, I maintain this opinion.

409.   "If impressions that satisfy targeting criteria for direct deals are on average more valuable than impressions that do not, then Enhanced Dynamic Allocation results in more valuable transactions being transacted through AdX rather than direct deals."[530]

410.   Google's experts do not address this claim, and I therefore maintain this opinion.[531]

---

[528] Expert Report of M. Weinberg, ¶139.

[529] Expert Report of M. Weinberg, ¶140.

[530] Expert Report of M. Weinberg, ¶142.

[531] This claim is tangentially addressed by Professor Milgrom's claims that any benefits to AdX are "competition on the merits." (Expert Report of P. Milgrom, ¶327.) I again do not have an opinion on what constitutes competitive versus anticompetitive

---

conduct, so this argument is irrelevant to my conclusions. Professor Milgrom objects to my conclusions regarding DA's impact on ad quality because my conclusions hold **if** some fact about ad/impression quality holds. I again do not have an opinion whether the inventory targeted by direct deals is higher than average, and so I do not state so. I do, however, have an opinion on how the auction mechanics of EDA would impact outcomes if this were the case, and so I offer this opinion.

## X.   APPLYING FIRST PRINCIPLES OF AUCTION THEORY,   OPINIONS OF GOOGLE'S EXPERTS' REGARDING LAST LOOK ADVANTAGE ARE INCORRECT.

411.  After careful review of Google's experts' rebuttals, I still maintain all opinions in the Weinberg Opening Report concerning Google's Last Look advantage. This section responds to Professor Milgrom's critiques pertaining to the Last Look advantage.

412.  First, the Milgrom Report claims that the Last Look advantage did not exist, because publishers according to the Milgrom Framework would aggressively "boost" Value CPMs into AdX.[532] I disagree, and still believe the Weinberg Framework (where publishers set Value CPMs according to Google's communication)[533] is most appropriate. For further discussion on this point, please see Section III. above. The Milgrom Report does not contest that the Last Look advantage exists in the Weinberg Framework.

413.  Second, the Milgrom Report claims that publishers benefited from Last Look.  In making this claim the Milgrom Report erroneously only compares Last Look to a counterfactual of "no AdX at all," instead of a counterfactual of "AdX does not have a Last Look advantage."[534]

414.  Third, this section corrects the mischaracterization of the Weinberg Opening Report's description of the Last Look advantage found in the Milgrom Report.

415.  Finally, this section concludes by reaffirming the following opinion from the Weinberg Opening Report.

416.  "Last Look helps AdX clear impressions that would have otherwise been cleared by the header bidding winner, by paying a penny more"[535]

---

[532] Expert Report of P. Milgrom, ¶¶376, 516-17.

[533] *See* Google Ad Manager Help, "Value CPM." Available at: https://support.google.com/admanager/answer/177222?hl=en ("Use the following formula to estimate the amount you should specify for your value CPM. Value CPM = Total revenue received from ad tags associated with selected line item / Total number of impressions Ad Manager sent to the selected line item x 1000.")

[534]  Expert Report of P. Milgrom, ¶518.

[535] Expert Report of M. Weinberg, Section V.C.1.

**A.  The Last Look advantage is real, and significant.**

417.  The Milgrom Report calls the Last Look advantage "dubious,"[536] claims "allegations [that Last Look is an advantage] are completely wrong,"[537] and further states "Plaintiffs' and their experts' conclusions are based on an incorrect qualitative analysis: after properly accounting for bidder and publisher incentives, my economic analysis finds that the so-called 'last look' did not provide AdX with an inherent advantage."[538]

418.  This claim pits the Milgrom Framework (that all publishers would recognize value CPMs of header bids as a revenue optimization tool and optimally set them as such) against the Weinberg Framework (that publishers would generally set value CPMs of header bids equal to the header bid itself, according to Google's communication)[539]. Please see Section V. for further discussion of the Weinberg Framework.

419.  The Milgrom Report provides several quotes supporting the Milgrom Framework. Of those quotes:

420.  One is anecdotal evidence. The Milgrom Report cites ███████████████████
███████████████████████████████████████████████████████████.") -- the
full quote is "████████████████████████████████████████████████████████
██████████████████████████████████████████████████████████████████████
██████████████████████████████████████." [540]

421.  Two only note that publishers are incentivized to boost header bids to optimize revenue, but do not discuss prevalence of publishers doing so.[541] The Weinberg Framework similarly acknowledges this incentive, and the Weinberg Opening Report explicitly notes it as well.[542]

---

[536] Expert Report of P. Milgrom, Section X ("HEADER BIDDING AND THE DUBIOUS "LAST LOOK ADVANTAGE")

[537] Expert Report of P. Milgrom, ¶363 ("These [Last Look] allegations are completely wrong.")

[538] Expert Report of P. Milgrom, ¶366.

[539] *See* Google Ad Manager Help, "Value CPM." Available at:  https://support.google.com/admanager/answer/177222?hl=en ("Use the following formula to estimate the amount you should specify for your value CPM. Value CPM = Total revenue received from ad tags associated with selected line item / Total number of impressions Ad Manager sent to the selected line item x 1000.")

[540] Expert Report of P. Milgrom, footnote 699 (*emphasis added*).

[541] GOOG-DOJ-14549757 and GOOG-DOJ-11406673. *See* Expert Report of P. Milgrom, footnote 699.

[542] *See* Expert Report of M. Weinberg, footnote 199.

422. One does state, as the Milgrom Report claims, that "[i]n practice, [...] many publishers [...] apply a boost to Header Bidding bids[.]"[543]

423. Two seem to *counter* the Milgrom Report's claim that boosting was prevalent.[544] ███

███████████████████████████████████████████
███████████████████████████████████████████
███████████████████████████████████████████
███████████████████████████████████████████
████████████████████████████

424. In summary, the evidence presented in the Milgrom Report is not sufficient to justify the Milgrom Framework that all publishers recognize Value CPMs as a revenue optimization tool and boost. In particular, only one cited document genuinely supports the Milgrom Framework, while two appear to directly contradict the Milgrom Framework.[545]

425. At the same time, there is ample evidence of Google employees discussing Last Look as though the norm is for publishers not to boost, and even advising publishers not to boost.

426. For example, the Milgrom Report quotes a deposition from Google engineer Nitish Korula who states "Up until at least December 2021, the winning bid from the Header Bidding auction was typically used to trigger a specific line item that the publisher had booked within Google's ad server (most commonly a remnant line item), and […] **the Value CPM of that line item could represent the winning Header Bidding bid as a floor in the AdX auction** (prior to September 2019) or as a competing bid in the Unified First Price Auction (from September 2019 onwards)."[546]

427. For example, an internal Google employee performance review document states "Recently, the widespread adoption of "header bidding" and an industry-wide push for auction fairness and transparency led to AdX (and AdMob, used by mobile app publishers) migrating to first-price

---

[543] GOOG-DOJ-09713317 at -19.

[544] ████████████████████████████████████████████████
████████████████████████████████████████████

[545] The others cite anecdotal evidence or acknowledge incentives, both of which are fully consistent with the Weinberg Framework.

[546] Declaration of N. Korula (Aug. 4, 2023), GOOG-AT-MDL-008842393, at ¶ 14 (emphasis added).

auctions, and giving up a "last look" advantage Google had (**essentially being able to see the Header Bidding bid before the 2nd price auction**). (emphasis added).[547]

428. Another internal Google slide deck regarding header bidding states "Monitor the Accuracy of your header bidders assessments […] a. **Ensure the true net e-CPM of key-value targeted lineitems is reflected in the lineitem**" as advice on a slide titled "Deeper dive on Best Practices."[548]In summary, the evidence supports the Weinberg Framework over the Milgrom Framework with regards to Last Look.[549]

429. Note that, *even for publishers who boosted as the Milgrom Report claims*, it is still preferable for advertisers to bid into a second-price auction with boosted reserve than a first-price auction because bidding into a truthful auction is simpler. Indeed, the Milgrom Report notes "Bidder-truthful auctions reduce bidding errors and the costs of bidding because they eliminate any need for an advertiser to assess who else might be bidding, how much they might bid, or the publisher's floor price."[550] The simplicity provided to AdX advertisers is therefore another aspect of the Last Look advantage, *even if publishers boosted as the Milgrom Report claims*.

430. Further note that, *even for publishers who boosted as the Milgrom Report claims*, AdX has the ability to lower the publisher's reserve by up to 20% under tDRS.[551]  This is even further evidence for the Weinberg Framework (during periods when Google used tDRS), because publishers would need to both know to boost Value CPMs *and* know to boost an extra 20% to compensate for tDRS.[552]

**B.  The Milgrom Report cannot establish that publishers "benefit from Last Look."**

431. The Milgrom Report claims "Publishers Benefited from the So-Called 'Last Look."[553]

---

[547] GOOG-DOJ-AT-00576443 at -43. This document is also discussed in Nirmal Jayaram's deposition.

[548] GOOG-AT-MDL-B-008151156 at 83.

[549] Even the evidence presented in the Milgrom report *in isolation* provides stronger evidence for the Weinberg Framework than the Milgrom Framework.

[550] Expert Report of P. Milgrom, ¶63.

[551] I state this interpretation of tDRS in the Weinberg Opening Report, and Google's experts do not contest it. *See* Expert Report of M. Weinberg, Section VII.C.

[552] And there is no evidence of any publishers realizing that Google could lower their price floor under tDRS. This makes sense, given Google's explicit communications to the contrary. *See* Section IV.

[553] Expert Report of P. Milgrom, Section X.C.

432.  Immediately after this claim, the Milgrom Report clarifies that this benefit is only claimed with respect to a counterfactual of publishers "don't use AdX at all": "Publishers could use header bidding to sell online display advertising impressions without ever calling GAM or another publisher ad server. But offering AdX bidders a chance to bid on inventory provided two important benefits for publishers."[554]

433.  From an Auction Theory perspective, "don't use AdX at all" is not a meaningful counterfactual to evaluate the mechanics of Last Look, as it conflates the mechanics of Last Look with increased demand due to AdX. Indeed, one of the two important benefits the Milgrom Report cites is this increased demand. To meaningfully claim that publishers "benefit from *Last Look*," rather than "benefit from calling AdX," the Milgrom Report would need to compare to a counterfactual that calls AdX without Last Look.

## C.  Correcting the Milgrom Report's mischaracterization of the Weinberg Opening Report.

434.  The Milgrom Report (correctly) quotes the Weinberg Opening Report as stating: "Dynamic Allocation allows AdX (and only AdX) to learn others' bids in a first-price auction format, and as a result, Dynamic Allocation creates information asymmetries that favor Google's AdX. This advantage is often referred to as AdX's Last Look advantage."[555]

435.  However, the Milgrom Report subsequently mischaracterizes that quote, by rebutting that "observing others' bids does not advantage bidders in a second-price auction. The reason is that a surplus-maximizing bidder in a second-price auction bids without regard to the floor price and the bids of other bidders."[556] This rebuttal suggests that the Weinberg Opening Report opines that AdX's Last Look advantage to come from allowing its bidders to bid smarter into a second-price auction.

436.  Instead, as described in the Weinberg Opening Report,[557] AdX's Last Look advantage came by allowing its bidders to win *whenever their value exceeded the highest header bid*. This is an advantage *because AdX bidders can submit a bid equal to their true value, whereas Header Bidders must shade their bids below their value to possibly profit.* Indeed, as the Milgrom

---

[554] Expert Report of P. Milgrom, ¶360.

[555] Expert Report of M. Weinberg, ¶119.

[556] Expert Report of P. Milgrom, ¶364.

[557] Expert Report of M. Weinberg, ¶159.b.ii.

Report notes, AdX bidders can optimally submit a bid equal to their true value[558] without knowing the winning header bid and still receive this benefit. And indeed, the numerical example in Appendix D of the Weinberg Opening Report[559] works through exactly this.

437.   Therefore, this response of the Milgrom Report's is not relevant to any claims in the Weinberg Opening Report, and my opinions have already accounted for the fact that AdX bidders can benefit from the Last Look advantage without themselves seeing the winning header bid.

**D.   Reaffirming the opinions in the Weinberg Opening Report concerning Last Look.**

438.   "Last Look helps AdX clear impressions that would have otherwise been cleared by the header bidding winner, by paying a penny more."[560]

439.   The Milgrom Report objects to this claim *only* by objecting to the Weinberg Framework.  The Milgrom Report raises *no objections* to the logic deriving this conclusion in the Weinberg Framework. As I elaborate in Sections IV. and V., the Weinberg Framework is significantly better justified (even just considering the Milgrom Report's own evidence in isolation). I therefore maintain this opinion.

---

[558] Except for the Deceptive Conducts of DRS, RPO, and Project Bernanke.

[559] Expert Report of M. Weinberg, Appendix D.

[560] Expert Report of M. Weinberg, Section V.C.1.

## XI. APPLYING FIRST PRINCIPLES OF AUCTION THEORY, OPINIONS OF GOOGLE'S EXPERTS' REGARDING RESERVE PRICE OPTIMIZATION ARE INCORRECT.

440. After careful review of Google's experts' rebuttals, I maintain all opinions in my Opening Report concerning Reserve Price Optimization. This section responds to Defendant's experts' critiques of my Opening Report pertaining to Reserve Price Optimization.

441. First, the Milgrom Report and Wiggins Report claim that other exchanges "implemented features similar to RPO."[561] [562] Based on a thorough reading of the documents cited by the Milgrom Report and Wiggins Report, I have not seen evidence that *any* ███████████████ ███████ "implemented features similar to RPO."[563]

442. Second, this section responds to Professor Milgrom's characterizations of GDN's exemption from RPO.[564] Contrary to the Milgrom Report's characterization and justification of this policy, this exemption demonstrates that RPO offered preferential treatment to GDN because: (a) the exemption policy was not communicated to non-Google tools, (b) the intent of the exemption policy was to exempt GDN with few other exemptions, and (c) the policy itself is biased in favor of tools with sufficient scale to frequently "second-price themselves."

443. Third, in response to the Milgrom Report's claim that "[n]one of the Plaintiffs' experts provide actual evidence of publishers with the preferences that they speculate "might" exist or point to examples of publishers claiming to be harmed by Google's RPO program,"[565] this section provides evidence of publishers losing revenue due to RPO.

444. Fourth, this section elaborates on academic research that studies bid-shading in response to RPO, which is used to correct a quantitative mistake of the Wiggins Report's execution of the Violation Count Reduction.

---

[561] Expert Report of P. Milgrom, ¶388 and n. 749.

[562] *See* Expert Report of S. Wiggins, n. 378.

[563] ██████████████████████████████████████████████████████████████ ████████████████████████████████████

[564] *See, e.g.*, Expert Report of P. Milgrom, ¶402.

[565] Expert Report of P. Milgrom, ¶411.

445. Fifth, this section corrects three mistakes in the Wiggins Report's execution of the Violation Count Reduction. Two of these are logical errors. The third should better leverage the aforementioned academic research.

446. Finally, in response to Google's expert's characterizations of RPO and their critiques of my analysis and discussion of RPO,[566] this section concludes by reaffirming the following opinions from my Opening Report:

   a. "Google concealed information that is material to both publishers and advertisers during the period RPO was concealed;"[567] [568]

   b. "…even after RPO was revealed, publishers might set suboptimal reserves on any impression for which RPO is a possibility."[569] [570]

   c. "RPO can prevent publishers from optimizing their revenue"[571] and "there are also reasons why some publishers might prefer outcomes without RPO than with RPO"[572]

   d. "RPO would lead to a payoff loss for advertisers since it leads to both a decrease in impressions won and an increase in the average price paid for impressions won"[573]

   e. "Advertisers would change their bidding behavior had Google revealed RPO during its initial implementation"[574] [575]

---

[566] Expert Report of P. Milgrom, Section XI.

[567] Expert Report of M. Weinberg, ¶273.

[568] Since issuing my Opening Report, I have reviewed further documents regarding the claimed disclosure of RPO by Google. These documents led me to believe that the disclosures by Google regarding RPO were insufficient. I now consider RPO to be concealed for its entire existence, since Google's disclosures withheld vital information regarding RPO.

[569] Expert Report of M. Weinberg, ¶273.

[570] As I mentioned above, I now consider RPO to be concealed for its entire existence. In the light of the new information I obtained since issuing my Opening Report, I would now rephrase this sentence to be "even *if* RPO was revealed, publishers might set suboptimal reserves on any impression for which RPO is a possibility."

[571] Expert Report of M. Weinberg, Section IX.A.1.

[572] Expert Report of M. Weinberg, ¶280.

[573] Expert Report of M. Weinberg, ¶281.

[574] Expert Report of M. Weinberg, Section IX.B.1.

[575] As I mentioned above, I now consider RPO to be concealed for its entire existence. In the light of the new information I obtained since issuing my Opening Report, I would rephrase this sentence as "Advertisers would change their bidding behavior had Google revealed RPO."

f.   "RPO allows AdX to increase the reserve price beyond what the publisher sets. Dynamic Revenue Sharing allows AdX to functionally lower the effective reserve price below what the publisher sets. Both conducts together allow AdX the flexibility to adjust the publisher-set reserve in either direction."[576]

### A.    The "similar programs" in Milgrom Report's and Wiggin's Report's list are not similar to RPO.

447.   The Milgrom Report ██████████████████ non-Google exchanges and claims they all "implemented features similar to RPO."[577] These same programs are also referenced in the Wiggins Report.[578]

448.   In my opinion there are two key features of a program that are required for it to be considered "similar to RPO." [579] First, RPO uses a buyer's past bids to set their future floors.[580] Moreover, RPO *targets* instances where a buyer's past bids are predictive of their future floors, and this is not an incidental consequence of learning from past data.[581]  Second, RPO was concealed from buyers, and Google took numerous steps to avoid detection.[582]

449.   ██████████████████ programs cited in Professor Milgrom's and Professor Wiggins' reports,[583] indicates the following:

a.    ████████████████████████████████████████████
████████████████ █████████████████████████████
███████████████████████████████████████████████
███████████████████████████████████████████████
███████████████████████████████████████████████

---

[576] Expert Report of M. Weinberg, ¶289.

[577] Expert Report of P. Milgrom, ¶388.

[578] *See* Expert Report of S. Wiggins, n. 378.

[579] Expert Report of P. Milgrom, ¶388.

[580] Expert Report of M. Weinberg, ¶¶274-275; Expert Report of Jacob Hochstetler, Section XIII.

[581] Expert Report of M. Weinberg, ¶¶274-275; Expert Report of Jacob Hochstetler, Section XIII.

[582] I have previously noted that I do not consider Google's "disclosure" of RPO to meaningfully disclose RPO; my  opinion remains the same for the entire duration of RPO.

[583] *See* Expert Report of P. Milgrom, footnote 749; Expert Report of S. Wiggins, footnotes 174, 175, 176, 177.

[584] ███████████████████████████████████████████████████████████

b.   ███████████████████████████████████

█████████████████████████ █ █████████████████

████████████████████

▪   █████████████████████████████████████

█████████████████████████████████

████████████

▪   █████████████████████████████████████

███████████████████████████████████████

███████████████████████████████████████

██████████████ ██████████████████████████

█████████████████████████████████████

████████████████████

▪  █████████████████████████████████████

██████████████████████████████████████ █ ██████

███████████████████████████████████████

███████████████████████████████████

---

585 ███████████████████████████████████████████
████████████████████

586 GOOG-TEX-00325057 at -58.

587 ████████████████████████████████████████
████████████████████████████████████████
████████████████████████████████████████
████████████████████████████████████████
████████████████████████████████████████
████████████████████████████████████

588 ████████████████████████████████████████
████████████████████████████████████████
██████████████████████

589 ████████████████████████████████

[REDACTED]

450. In summary, there is no evidence supporting elements of similarity between any of the four cited programs and RPO. [REDACTED]

[REDACTED] However, just because these programs address a similar challenge does not immediately imply they have "similar features to RPO" [593] -- the concerns stated in my Opening Report regarding RPO stem from its particular implementation and communication, not from the mere fact that it updates publishers' reserves to optimize revenue.

## B.    The Milgrom Report Incorrectly Characterizes GDN's exemption from RPO.

451. The Milgrom Report notes, and Google documents confirm, that GDN was exempt from RPO, but the Milgrom Report incorrectly characterizes this exemption.[594] Indeed, rather than this policy being designed to "respond to auction 'thinness' created by buy-side tools' decisions to employ single-bid policies,"[595] Google documents show that this policy was created, at least in large part, to provide preferential treatment towards GDN.

---

[590] [REDACTED]

[591] [REDACTED]

[592] [REDACTED]

[593] Expert Report of P. Milgrom, ¶388.

[594] See Expert Report of P. Milgrom, ¶402.

[595] Id.

a.  The exemption policy states the following: "whitelist for RPO exemptions only those buyers that yield a revenue lift of ███████████████████████████ ██████████"[596] That is, ad buying tools are exempt from RPO if and only if their second-price[597] results ████████████████████████████ ████████████████████████. Note, in particular, that the only role RPO plays in the counterfactual is in ██████████████████████████████ ████████████████████████████████████.

452.  In analyzing this exemption policy I note first that, as a matter of Auction Theory, *every advertiser would prefer to be exempt from RPO if given the option*. This is because RPO *can only raise the reserve an advertiser must clear to win*, and *every advertiser prefers to face lower reserves if given the choice.*[598] Therefore, exemption from RPO is quite a material gain for ad buying tools.

453.  Second, internal Google documents show that, whatever justification was ultimately given for the RPO exemption policy, the true goal behind the exemption was to "come up with a reasonable-looking policy by which adwords would be exempt by a comfortable margin, while buyers who do not submit multiple bids would not be exempt."[599]

454.  Third, internal Google documents confirm that this exemption policy was *not communicated to non-Google products*.[600] Google products are therefore the only products that even knew of the exemption policy and whether they were currently exempted, while non-Google products did not.

---

[596] GOOG-DOJ-13212948, at -948.

[597] Or "min cpm" payments – whatever information the ad buying tool shares as a lower bound on the payment it promises by winning, even if all other bids and AdX's reserve is lower.

[598] Krishna, Vijay. *Auction theory*. Academic press, 2009.

[599] GOOG-DOJ-28486313 at -15. The Milgrom Report further notes that one motivation for this is concerns about "interaction of Project Bernanke and RPO." Expert Report of P. Milgrom, ¶402.

[600] *See* GOOG-DOJ-28486313 at -15 and -16 ("We would not commercialize the new exemption policy. Buyers would not know about the exemption policy unless the [sic] discovered it through experimentation. Buyers would not be able to see how much incremental revenue they've provided through self-second pricing and would not know if they were currently being exempted from RPO. There wouldn't be any information on the exemption policy in the help center or comms doc. If we ever needed to reveal the policy reactively, we could either do so at a high level ("we exempt buyers that provide sufficient second price support from optimized pricing in the open auction," or we could go into specifics about the current exemption mechanism with the caveat that it could change over time.)")

455.  Finally, the exemption policy itself is preferential towards ad buying tools that are large enough to provide significant revenue lift by "second-pricing themselves," and the Milgrom Report errs when describing the exemption.

a.  The Milgrom Report inaccurately describes this policy as exempting "buyers for which the calculated increase in revenue from the second bid it submitted (compared to submitting only its high bid) ███████████████████████████████████

███████████████████████████████████████████████████████████████

██ "[601] This is incorrect – Google never calculated a simulated increase in revenue due to RPO, █████████████████████████████████████ .

b.  This distinction is material because in order for an ad buying tool to provide ████

██████████  by second-pricing themselves, that ad buying tool must often second-price itself. Often second-pricing oneself requires scale, because one must often have *both* the highest *and* second-highest bids for an impression.

c.  In addition, this particular policy is not "consistent with RPO being designed in part to respond to auction "thinness" created by buy-side tools' decisions to employ single-bid policies" as the Milgrom Report claims. It is entirely possible for an ad buying tool to regularly second-price itself at (say) 50% of the winning bid, and for this second-price to often set the clearing price, thereby providing significant revenue lift. At the same time, RPO would provide even greater revenue lift, if it could regularly target a reserve between 50% and 100% of the winning bid. Yet, such an ad buying tool would be exempt from RPO anyway.

d.  In summary, contrary to the Milgrom Report's treatment of this policy, both the substance of the exemption policy and the decision to conceal the exemption policy form non-Google products preferences GDN at the expense of non-Google ad buying tools.

---

[601] Expert Report of P. Milgrom, ¶402. When I first read Professor Milgrom's report, I found this description inconsistent with what I would expect from an Auction Theory perspective. Due to Project Bernanke, there is a large gap between GDN's first- and second-highest bid. An internal Google email notes that the *median* gap is ████████████ , and the *average* gap is ████ ████ (GOOG-DOJ-15426837 at -40.) Given that ███████████████████████████████ , from an Auction Theory perspective I would expect RPO to give significant revenue lift when compared to a second-price that is ████████ ████████████ . From an Auction Theory perspective, I would not expect a second-price that is ████████████████ to ██████████████████████████████████ . Indeed, this is reconciled by simply correcting the Milgrom Report's description of the RPO exemption.

C.    **The Milgrom Report is incorrect that there is no evidence that some publishers might have preferred no RPO.**

456.  The Milgrom Report notes that my Opening Report claims "some publishers might prefer outcomes without RPO than with RPO."[602] The Milgrom Report responds by claiming: "None of the Plaintiffs' experts provide actual evidence of publishers with the preferences that they speculate "might" exist or point to examples of publishers claiming to be harmed by Google's RPO program. Nor am I aware of any such evidence."[603]

457.  Yet one such example is found in a paragraph of a Google document that is cited by the Milgrom Report: "For RPO, some buyers are changing their bids. Turn off RPO reserve price for such buyers. ███████████████████████████████. The former 2 reactions make sense, no-one understands the latter. *But turning it off for this group gives 1.4% revenue lift!*"[604]

458.  Another such example: "If we look at pubs making at least $70/week, there's one pub with 5.8% revenue drop, 5 others with > 2% revenue drop, and 9 pubs with revenue drop between 1 and 2%."[605]

459.  Even if, as the Milgrom Report claims, RPO is generally successful at optimizing revenue, that result is fully consistent with RPO failing some publishers and those publishers therefore preferring to trust their own optimization instead of Google's.

D.    **Academic research on Sophisticated buyers responding to RPO refutes the suggestion in the Wiggins Report that advertisers aware of RPO may not have shaded their bids**

460.  The Wiggins Report suggests that the statement in my Opening Report that "if the advertiser were aware of RPO, they would have shaded their bid from the beginning"[606] is somehow

---

[602] Expert Report of P. Milgrom, ¶411.

[603] Expert Report of P. Milgrom, ¶411.

[604] GOOG-TEX-00831373, at -378. This quote comes from a source cited in Professor Milgrom's report. Moreover, Professor Milgrom *cites parts of this paragraph* as evidence that buyers are reacting strategically to RPO. *See* Expert Report of P. Milgrom, ¶32.b. This quote demonstrates a subpopulation (of advertisers) for which RPO is hurting publishers' revenue, and turning RPO off improves revenue.

[605] GOOG-AT-MDL-B-006365895 (listed as item 204 on the Materials Considered List of my Opening Report).

[606] Expert Report of M. Weinberg, ¶ 285.

speculative or unfounded.[607]   In response, I provide here a detailed prediction of how a "sophisticated" advertiser who was not deceived about RPO would bid-shade in response to RPO, as supported by the state-of-the-art for academic research on this topic.

461.  The most relevant models are the following:

> **i.   There are multiple sequential impressions for sale to at least one bidder.**
>
> **ii.  Initially, the auctioneer does not know any bidder's value, and believes each bidder's value to be drawn independently from some distribution with CDF F.**
>
> **iii. Each bidder is *flat*: once their value is drawn from F, they have the same value for every impression.**

462.  Four relevant works consider the "thinnest" possible markets with just a single bidder. These papers establish that if the buyer and seller play in Perfect Bayesian Equilibrium of the complete repeated game, the seller earns *zero revenue on average*.[608] Intuitively, any purchase the buyer makes one day signals to the seller that they should charge more the next day, and the future loss from increased prices outweighs the present gain from winning this single impression.

a.   Importantly, this suggests that if RPO were truly targeting "thin" markets that are approximated by a single interested buyer, a "sophisticated" buyer would respond to RPO with such hyper-aggressive bid-shading that AdX revenue would plummet (and moreover, for cases where there is literally a single flat buyer, these papers *prove* this outcome).

b.   Also importantly, a seller who *commits to setting the same price every day* can extract non-zero revenue (for example, by setting the optimal price for F every day). This demonstrates the power of commitment: a seller who commits not to use the buyer's

---

[607] Expert Report of S. Wiggins, ¶ 145.

[608] Hart, Oliver D., and Jean Tirole. "Contract renegotiation and Coasian dynamics." The Review of Economic Studies 55.4 (1988): 509-540; Klaus M Schmidt. 1993. Commitment through incomplete information in a simple repeated bargaining game. Journal of Economic Theory 60 (1993), 114–114; Devanur, N. R., Peres, Y., and Sivan, B. Perfect bayesian equilibria in repeated sales. In Proceedings of the Twenty-Sixth Annual ACM-SIAM Symposium on Discrete Algorithms, SODA 2015, San Diego, CA, USA, January 4-6, 2015 (2015), pp. 983–1002; Immorlica, Nicole, et al. "Repeated sales with multiple strategic buyers." Proceedings of the 2017 ACM Conference on Economics and Computation. 2017.

revealed information against them encourages the buyer to reveal information and make purchases.

463. The last work in this series also considers a market with multiple buyers.[609] Their work demonstrates a Perfect Bayesian Equilibrium with non-zero revenue under some assumptions, but with *less revenue than a second-price auction with no reserve at all*.

464. That is, all works in this model demonstrate that if flat Sophisticated advertisers best respond to dynamic reserves, the resulting revenue is worse than with no reserve at all.[610] On the other hand, committing not to change an optimal reserve over time results in better revenue than no reserve at all.

465. In summary, these academic works support conclusions my Opening Report and this Rebuttal Report have drawn:

   a.  Academic research predicts advertisers who are Sophisticated and Fully Informed of RPO in "thin" markets would bid-shade hyper-aggressively.

   b.  It would be quite risky for Google to develop and launch RPO under the belief that all or most advertisers are Sophisticated.

   **E.  The Wiggins Report makes significant material mistakes implementing the Violation Count Reduction for RPO.**

466. When executing the Violation Count Reduction, the Wiggins Report concludes that "(i) all AdX transactions for which a Google Ads bid set the clearing price (regardless of whether Google Ads or another bidder won); and (ii) all AdX transactions that Google Ads won and where a price floor set the clearing price"[611] could not be affected in "(i) the clearing price, (ii) the winning bidder, (iii) whether the transaction cleared on AdX, or (iv) AdX's revenue share"[612] if only non-GDN advertisers shaded their bids, but GDN bids remained constant.

---

[609] Although their work considers a non-auction pricing model: the seller sets a price on each day, and buyers can only choose to enter or leave. If at least one buyer enters, a random such buyer wins and pays the price. Importantly, this differs from an auction setting because buyers cannot guarantee victory by increasing their bid. Academic research has yet to tackle this problem in the auction model, and the cited work leaves this as an open problem.

[610] In the single-buyer case, no reserve at all yields zero revenue.

[611] Expert Report of S. Wiggins, ¶147.

[612] Expert Report of S. Wiggins, ¶142.

Section IV. describes why this is relevant for the Wiggins Report's execution of the Violation Count Reduction. Below I set out an example demonstrating a simple logical flaw in this claim.

467. In this example: (a) a non-GDN bidder wins, (b) a Google Ads bidder sets the clearing price, and (c) if the non-GDN bidder were to bid-shade, this could change both (i) the clearing price, and (ii) the winning bidder.

468. Consider an example where the top non-GDN AdX bidder bids $12, the top GDN bidder bids $10, the AdX reserve is $8 (for everyone), and the second-top non-GDN bidder is $7.

   a.   The non-GDN bidder then wins, and a GDN bidder sets the clearing price (of $10).

   b.   If the top non-GDN bidder were to bid-shade to $9, then the impression would clear at $9 instead of $10, and the GDN bidder would now win. So both the clearing price and winner have changed.

469. Therefore, the Wiggins Report's exclusion of "all AdX transactions for which a Google Ads bid set the clearing price (regardless of whether Google Ads or another bidder one)"[613] as not explicitly affected by non-GDN bid-shading in response to RPO is logically flawed. The above example shows such transactions can indeed be explicitly affected by non-GDN bid-shading in response to RPO.

470. Next, consider an example where (a) Google Ads won, (b) a price floor set the clearing price, and (c) if a non-GDN bidder were to bid-shade in response to RPO, this could change both (i) the clearing price and (ii) the winning bidder.

471. In this second example, the top Google Ads bid is $12, the Google Ads reserve is $10, the top non-GDN bid is $15 and the non-GDN RPO reserve is $20.

   a.   Given those values the top Google Ads bid wins, and the clearing price is set by the Google Ads price floor.

   b.   But if the non-GDN bidder bid-shaded *in previous auctions* in response to RPO, this would lower their RPO reserve *in this auction*. That is, bid-shading in response to RPO could lower the non-GDN RPO reserve to (say) $10, and the non-GDN bidder could

_____

[613] Expert Report of S. Wiggins, ¶147.

win this auction with a bid of (say) $13. This would change both the clearing price (from $10 to $12) and winner (from Google Ads to non-GDN).

472. Therefore, the Wiggins Report's exclusion of "all AdX transactions that Google Ads won and where a price floor set the clearing price"[614] as not explicitly affected by non-GDN bid-shading in response to RPO is logically flawed. The above example shows such transactions can indeed be explicitly affected by non-GDN bid-shading in response to RPO.

473. In summary, neither of the Wiggins Report's two claims are correct, and therefore *both* of these exclusions should be undone when executing the Violation Count Reduction.

474. The Wiggins Report makes a third error when quantifying the "but for" bid-shading in response to RPO. In particular, the Wiggins Report estimates that advertisers ▮▮▮▮▮▮▮▮▮▮▮▮▮ in response to RPO,[615] because "[t]his is the same amount of bid shading as Project Poirot found would be optimal for DV360 to use when bidding into ▮▮▮▮▮▮▮▮▮▮▮."[616] This reasoning is flawed, because bid-shading in response to RPO is fundamentally different than bid-shading in a first-price auction. Indeed, I have just cited academic research predicting a bid-shading of *100%*.[617]

### F.    Reaffirming certain opinions in my Opening Report concerning RPO challenged by Google's experts.

475. Various opinions advanced in my Opening Report were challenged by Google's experts and I respond to those challenges and reaffirm my opinions herein. I also highlight herein certain opinions in my Opening Report that were not addressed by Google's experts and confirm that Google's reports have not changed any such opinions.

---

[614] Expert Report of S. Wiggins, ¶147.

[615] Expert Report of S. Wiggins, ¶295.

[616] Professor Wiggins further estimates this "likely overstates the incentive to shade, causing me to overstate the gains to Google from the alleged deception. One reason is that any benefit from shading because of RPO comes from an impact on future price floors, rather than direct returns from the current auction. Because firms discount future benefits and costs, the impact of paying a higher price in the future is smaller than the impact of paying a higher price today. A second reason is that even when RPO affects a transaction, the clearing price is less than the winning bid. That fact implies that my estimate of how often advertisers are charged their bid is overstated, which in turn implies that my estimate of shading is overstated." Expert Report of S. Wiggins, ¶318.

[617] While these models do not literally capture RPO in all settings, they serve as a much better starting point than qualitative intuition. Moreover, these models do literally capture RPO in exceptionally "thin" markets with one competitive bidder with flat values.

476.  First, my Opening Report stated both that: (1) "Google concealed information that is material to both publishers and advertisers during the period RPO was concealed"[618] [619]; and (2) "[a]dvertisers would change their bidding behavior had Google revealed RPO during its initial implementation."[620] [621]

    a.  In response to these opinions, the Milgrom Report argued that "[f]or advertisers, knowledge of RPO was not necessary for buy-side tools to optimize bids: in the absence of RPO, publishers could (and did) use historical data to set floor prices, so that a surplus-maximizing bidder would account for that possibility both when RPO was in place and before."[622]

        i.  However, Section IV. discusses why there is a significant material difference between RPO affecting **all publishers** by **automating** dynamic pricing in a manner that **explicitly targets situations where an individual buyer's past bids are predictive of their future bids**,[623] and **some publishers** choosing to **manually** update floor prices by "**using historical data**." Therefore, this argument in the Milgram Report is incorrect.[624]

---

[618] Expert Report of M. Weinberg, ¶273.

[619] Since issuing my Opening Report, I have reviewed further documents regarding the claimed disclosure of RPO by Google. These documents led me to believe that the disclosures by Google regarding RPO were insufficient. I now consider RPO to be concealed for its entire existence, since Google's disclosures withheld vital information regarding RPO.

[620] Expert Report of M. Weinberg, Section IX.B.1.

[621] As I mentioned above, I now consider RPO to be concealed for its entire duration. In the light of the new information I obtained since issuing my Opening Report, I would rephrase this sentence as "Advertisers would change their bidding behavior had Google revealed RPO."

[622] Expert Report of P. Milgrom, ¶390.

[623] ███████████████████████████████████████████████████████

[624] Moreover, the "evidence" Professor Milgrom cites to assert that publishers "use(d) historical data to set floor prices" consists of: (a) the Google launch of RPO, asserting that publishers already did this, and (b) a quote from an internal Google discussion claiming that advertisers already share this information with "Yield Managers." (Expert Report of P. Milgrom, ¶390) I do not find (a) to be convincing evidence – it is just a launch claiming that there is evidence elsewhere. When quoting (b), the Milgrom Report writes "No expectation of bid privacy: other platforms like yield managers [] already give publishers full buyer bid information and therefore the buyers might not care." (GOOG-DOJ-15588979, at -979) The full quote is: "No expectation of bid privacy: other platforms like yield managers **(examples?)** already give publishers full buyer bid information and therefore the buyers might not care" *(emphasis added)* (GOOG-DOJ-15588979, at -979.) Therefore, I also do not find this

HIGHLY CONFIDENTIAL

    b.    The Milgrom Report also states that "Google disclosed RPO roughly a year after it launched, so any potential impacts from the alleged "concealment" would have been short-lived."[625]

        i.    However, Section IV. also discusses why this is not a meaningful disclosure, and the Wiggins Report further contains an analysis claiming that advertisers were just as deceived by RPO pre- and post-disclosure.[626]

    c.    The Wiggins report states "[a]s described in Section II.B., as a general rule, advertisers, advertising agencies, and ad buying tools monitor performance and run experiments to help advertisers optimize their bidding strategies. By contrast, neither Mr. Andrien nor Professor Weinberg have presented evidence that advertisers commonly study announcements regarding optimization features and formulate their strategies based on those announcements. The fact that advertisers continually monitor performance and learn to adopt optimal strategies based on their observations means that they would continue to do so regardless of whether RPO was publicly announced. As a result, outcomes in the actual and but-for worlds would be the same, which indicates that Google did not profit from the alleged deception."[627]

        i.    However, this response claims *only* that Google's uninformative text "disclosure" would not influence advertiser behavior. I agree that Google's uninformative text "disclosure" would not influence advertiser behavior. This argument does not address how advertisers would have behaved if RPO were transparently disclosed.

---

to be strong evidence that publishers are already doing this. In any case, I have already opined above that there is a significant difference between what Professor Milgrom claims publishers may have already been doing and what Google did with RPO.

[625] Expert Report of P. Milgrom, ¶390; *see also* "But all of the Plaintiffs' experts overlook the fact that Google had flagged to its customers as early as 2014 the possibility of an optimization like RPO that modified a publisher's floor prices on some impressions. Moreover, RPO was officially announced to the public on May 12, 2016, roughly a year after the program was launched, so any potential impacts from the alleged "concealment" of RPO would have been short-lived." (Expert Report of P. Milgrom, ¶406)

[626]*See* Expert Report of S. Wiggins, ¶189 ("even if RPO had been disclosed, it is unlikely that advertisers would have changed their behavior or strategies from what they were already doing.") Professor Wiggins' report intends to argue that they were not deceived before and after the disclosure. I instead opine they were both deceived before and after the disclosure. But both reports claim they were deceived the same amount before and after the disclosure.

[627] Expert Report of S. Wiggins, ¶188.

d.  The Wiggins Report further states: "In both worlds—with and without the disclosure of RPO—advertisers would have learned how to shade their bids to arrive at the same optimal bidding strategy. Similarly, to the extent that it was optimal for publishers to change their floors given the operation of RPO, publishers would have done so regardless of whether RPO was disclosed because, in both the actual and but-for worlds, they would monitor returns and perform experiments to arrive at the optimal price floors."[628]

> i.  However, Section V. justifies using the Weinberg Framework as appropriate to evaluate the impact of Google's Deceptive Conduct, in large part due to Google's successful Deceptive Conduct in concealing RPO from advertisers and ad buying tools, thereby preventing advertisers and publishers from learning optimal strategies.

e.  I therefore maintain both of these opinions.

477.  My Opening Report also offered the opinion that "even after RPO was revealed, publishers might set suboptimal reserves on any impression for which RPO is a possibility." [629] [630]

a.  Google's experts do not address this point,[631] and I maintain this opinion.

478.  My Opening Report opined that "RPO can prevent publishers from optimizing their revenue" [632] and "there are also reasons why some publishers might prefer outcomes without RPO than with RPO" [633]

a.  The Milgrom Report argues that "[RPO] was designed to support publishers 'to earn the most money possible, with the least complexity,' and the simplicity of its automation together with the significant increases in publisher revenues that Google

---

[628] Expert Report of S. Wiggins, ¶190.

[629] Expert Report of M. Weinberg, ¶273.

[630] As I mentioned above, I now consider RPO to be concealed for its entire existence. In the light of the new information I obtained since issuing my Opening Report, I would rephrase this sentence as "even *if* RPO was revealed, publishers might set suboptimal reserves on any impression for which RPO is a possibility."

[631] Professor Milgrom's report responds to my later claim that RPO generally created obstacles to some publishers optimizing revenue but does not respond to this specific claim.

[632] Expert Report of M. Weinberg, Section IX.A.1.

[633] Expert Report of M. Weinberg, ¶280.

measured in its RPO experiments (discussed in Paragraph 404 above) show that the program was very successful in achieving those goals. None of the Plaintiffs' experts provide actual evidence of publishers with the preferences that they speculate "might" exist or point to examples of publishers claiming to be harmed by Google's RPO program. Nor am I aware of any such evidence."[634]

    *i.*    In response I highlight such evidence in Section IV. and V., including one source that *immediately follows a quote cited in the Milgrom Report*.[635] As a result, the Milgrom Report's argument is incorrect and unfounded.

    b.    The Milgrom Report also argues: "In reality, RPO was a service that helped publishers that had set some floor prices too low by raising those floor prices to increase their revenues, and Google experiments found that RPO had very large benefits for publishers. RPO did not prevent publishers from running experiments that could identify further improvements or even revenue-maximizing floor prices. Also, if a publisher had chosen the revenue-maximizing floor price for an impression, RPO would make no change to the floor price applied for that publisher. These same observations undermine Professor Weinberg's additional claim that "even after RPO [was] disclosed, publishers would still face challenges setting optimal reserves under RPO.""[636]

    *i.*    This argument does not actually address the substance of my Opening Report's claim. My Opening Report claims the reason publishers would still face challenges setting optimal reserves under RPO is "if a publisher wishes to lower the reserve it sets on AdX to give RPO more flexibility, they would want to know exactly on which auctions RPO is active. If a publisher prefers to trust their own optimization over Google's, they would further want to know not only whether RPO is active, but also exactly what reserve RPO is setting (so they can set what they consider to be the optimal reserve exceeding RPO's)."[637] The Milgrom Report's argument does not address this substance, as it does not

[634] Expert Report of P. Milgrom, ¶411.

[635] *See* GOOG-TEX-00831373, at -378.

[636] Expert Report of P. Milgrom, ¶413.

[637] Expert Report of M. Weinberg, ¶279.

explain how a publisher could learn the reserve prices set by RPO nor on which auctions RPO is setting a reserve.

c. Because the Milgrom Report's first argument in unconvincing (and Section XI.), and the second argument does not address the reasoning in my Opening Report, I maintain this opinion.

479. My Opening Report also opines that "RPO would lead to a payoff loss for advertisers since it leads to both a decrease in impressions won and an increase in the average price paid for impressions won" [638]

a. The Milgrom Report argues that "RPO was designed to increase publishers' revenues, and it was successful at doing just that, with the initial versions of the program increasing publisher revenues ████████████ and later updates increasing publisher revenues even further."[639]

    i. However, it is fully consistent that RPO is designed to increase publishers' revenues, and that RPO succeeded in doing so, and that it leads to a payoff loss for advertisers. The Milgrom Report therefore does not properly address or rebut this opinion in my Opening Report.

b. The Baye Report states "although Professor Weinberg asserts that RPO led to increased ad prices for advertisers, it typically increased publisher revenue and had an "indeterminate" effect on AdX, he conducts no analysis on data to demonstrate his conclusions. Additionally, Professor Weinberg makes no attempt to balance alleged harm to advertisers and benefit to publishers, does not suggest RPO impaired the ability of third-party exchanges to compete, and therefore does not demonstrate harm to competition."[640]

    i. In response, I first note that there is no need for data to demonstrate that RPO led to increased ad prices for advertisers – the description of RPO clearly states

---

[638] Expert Report of M. Weinberg, ¶281.

[639] Expert Report of P. Milgrom, ¶390.

[640] Expert Report of M. Baye at ¶118.

that RPO can only increase the reserve price faced on AdX and never decrease it.[641]

    ii.    Second, I am an auction theorist, and therefore do not opine on the balance of harm to advertisers versus benefit to publishers, nor harm to competition.

    c.    As the responses contained in the Milgrom and Baye reports are fully consistent with this conclusion, I maintain this opinion.

480.  My Opening Report also opined that "RPO allows AdX to increase the reserve price beyond what the publisher sets. Dynamic Revenue Sharing allows AdX to functionally lower the effective reserve price below what the publisher sets. Both Deceptive Conducts together allow AdX the flexibility to adjust the publisher-set reserve in either direction." [642]

481.  Google's experts do not address this claim, and I therefore maintain this opinion.

## XII. APPLYING FIRST PRINCIPLES OF AUCTION THEORY, OPINIONS OF GOOGLE'S EXPERTS' REGARDING DYNAMIC REVENUE SHARE ARE INCORRECT.

482.  After careful review of Google's experts' rebuttals, I still maintain all opinions in the Weinberg Opening Report concerning Google's Dynamic Revenue Share. In this section, I conclude the following:

483.  First, the Milgrom Report, Wiggins Report, and Bayes Report claim that DRS's impact should be evaluated according to the Milgrom Framework as opposed to the Weinberg Framework. After analyzing their reports, the Weinberg Framework is most appropriate to evaluate DRS's impact. For additional information supporting the Weinberg Framework over the Milgrom Framework, please see Section V. above.

484.  Second, this section elaborates on a point made in Section IV. that if tDRS is to have any impact, it can only be because: (a) publishers set suboptimal reserves, so tDRS helps them by lowering their reserves, or (b) tDRS lowers publishers' reserves in a manner that is good for Google but suboptimal for publishers.

---

[641] *See* Expert Report of P. Milgrom, ¶388 ("RPO increased the floor price sent to a bidder on AdX when Google predicted.".)

[642] Expert Report of M. Weinberg, ¶289.

485. Third, this section comments on the Milgrom Report's mathematical conclusions regarding DRS. One such conclusion has a logical flaw and is incorrect. For the remaining conclusions, this section assesses their *relevance* to analyzing the impacts of DRS in practice.

486. Fourth, this section responds to individual rebuttals in the Milgrom Report.

487. Fifth, this section observes that Google's decision to exempt its own ad buying tools from DRSv2 is disparate treatment.

488. Finally, this section concludes by reaffirming the following opinions from the Weinberg Opening Report.

    a.   "Dynamic Revenue Sharing version 1 (DRSv1) increased AdX win rate and revenue and decreased non-AdX exchanges' win rates and revenues, compared to no DRS"[643]

    b.   "Dynamic Revenue Sharing version 2 (DRSv2), in comparison to both no DRS and DRSv1, decreased advertiser payoff, increased AdX win rate and revenue, decreased non-AdX exchange's win rates and revenues, and may also decrease publisher revenue"[644]

    c.   "tDRS would lead to an increase in AdX's revenue and win rate as compared to no DRS."[645]

    d.   "Google concealed information that is vital to advertisers and important to publishers by concealing DRSv1 from them."[646]

       i.   "Publishers would have set different reserve prices to maximize their revenues had Google revealed DRSv1"[647]

    e.   "DRSv1 is a dirty second-price auction and as a result, DRSv1 is not truthful."[648]

    f.   "At least some of Google's communication regarding DRSv2 was misleading"[649]

---

[643] Expert Report of M. Weinberg, ¶12.d.i.

[644] Expert Report of M. Weinberg, ¶12.d.ii.

[645] Expert Report of M. Weinberg, ¶223.

[646] Expert Report of M. Weinberg, ¶12.d.iv.

[647] Expert Report of M. Weinberg, Section VII.D.1.

[648] Expert Report of M. Weinberg, ¶195.

[649] Expert Report of M. Weinberg, ¶183.c.

    i.    "For DRSv2, Google states: "Buyers are never charged more than their bid," I find this claim exceptionally misleading to advertisers."[650]

    ii.   "For DRSv2, Google states: "sellers are always paid at least their reserve." I find this claim misleading to publishers."[651]

    iii.  "Google states "Before or after the July change, we still do NOT pay publishers below publisher's floor…" I find this claim quite misleading to publishers concerning tDRS."[652]

g.    "DRSv1, DRSv2, and tDRS all naturally exacerbate all conclusions regarding non-AdX exchanges under Dynamic Allocation and Enhanced Dynamic Allocation."653

h.    "DRSv1 was likely neutral to AdX advertisers' payoffs, although may have had some negative impact."654

    i.    "Advertisers would have submitted different bids to maximize their payoffs had Google revealed DRSv1"[655]

    ii.   "DRSv2 led to a decrease in AdX advertisers' payoffs"[656]

    iii.  "DRSv2 was quite negative towards AdX advertisers' payoffs"[657]

    iv.  "If all advertisers responded optimally to DRSv2, no advertiser would bid in the dynamic region, and therefore DRSv2 would be equivalent to no DRS."[658],[659]

[650] Expert Report of M. Weinberg, ¶231.a.

[651] Expert Report of M. Weinberg, ¶231.b.

[652] Expert Report of M. Weinberg, ¶231.d.

[653] Expert Report of M. Weinberg, ¶224.

[654] Expert Report of M. Weinberg, ¶225.

[655] Expert Report of M. Weinberg, Section VII.F.2.

[656] Expert Report of M. Weinberg, Section VII.F.1.

[657] Expert Report of M. Weinberg, ¶226.

[658] The "dynamic region" is the range between the publisher-set reserve of r and the effective reserve of r/0.8. Expert Report of M. Weinberg, ¶ 206.

[659] Expert Report of M. Weinberg, ¶226.a.

    v.   "No matter how an advertiser responds to DRSv2, they cannot possibly be better off than no DRS."660

    vi.  "Bid-shading in the dynamic region does not improve an advertiser's outcomes over truthful bidding, they must skip the dynamic region entirely in order to better respond to DRSv2 over truthful bidding."661

## A.    DRS's impact should be evaluated according to the Weinberg Framework.

489.    The Weinberg Opening Report evaluated DRS's impact according to the Weinberg Framework – focusing on Default advertisers who bid truthfully into an auction that Google claims is second-price. The Milgrom Report contests this analysis and claims a proper analysis should instead use the Milgrom Framework and focus on Sophisticated advertisers who optimize their bids into an auction Google describes as truthful.

490.    The Weinberg Framework is the appropriate method to evaluate DRS's impact.  As mentioned in Section V., above (discussing the Weinberg and Milgrom Frameworks), the Default advertiser is the appropriate lens to view advertisers

491.    As discussed in detail in Section V., the Weinberg Framework applies – as opposed to the Milgrom Framework. Therefore, any rebuttals by Google's experts that only contest the Weinberg Framework are incorrect.

## B.    tDRS cannot help optimal publishers.

492.    The Weinberg Opening Report claims that tDRS is equivalent to allowing Google to adjust the publisher's reserve down by up to 20%.662 Google's experts do not contest this claim.

493.    Therefore, if a publisher were already setting optimal reserves, and Google acted exclusively in the publisher's interest, tDRS would be moot.

---

660 Expert Report of M. Weinberg, ¶226.b.

661 Expert Report of M. Weinberg, ¶226.c.

662 *See* Expert Report of M. Weinberg, ¶215 ("Assuming that all debt is cleared, the publisher receives an 80% revenue share across all auctions AdX clears, and AdX receives payment exactly according to a second-price auction with reserve r* = max{R/0.8, r/x}. In particular, if we count debt when it is accumulated rather than when it is ultimately paid (call this the publisher's debt-aware payout), then the publisher receives 80% revenue share of a second-price auction with reserve r* = max{R/0.8, r/x} on a per-auction basis. In particular, observe that if r > R and x > 0.8, the publisher's debt-aware payout can be less than their price floor.") r* can be as low as r, which results in a debt-aware payout to the publisher as low as 0.8*r, which is 80% of their floor.

494. Additionally, I note that "optimal" is different from Google's perspective and the publisher's perspective. Specifically:

   a. AdX has an opportunity cost of *zero* for selling the impression on AdX – AdX gets no revenue if the impression clears elsewhere.

   b. The publisher has an opportunity cost greater than 0 for selling the impression on AdX – if the impression does not clear on AdX, the impression might clear later in the waterfall, or perhaps there is already a non-zero header bid in hand.

   c. The optimal price for a seller takes into account the opportunity cost, and in particular the optimal price always *increases* with the opportunity cost. [663] Therefore, the optimal price from the publisher's perspective is larger than the optimal price from AdX's perspective, and tDRS therefore gives AdX the flexibility to lower a reserve that is optimal for the publisher to one that is preferable to AdX.

### C.    Commenting on the Milgrom Report's DRS theorems.

495. This section provides additional context for the Milgrom Report's Theorems with respect to DRS.

496. Theorem 4 of the Milgrom Report states: "If publishers did not change their floor prices and bidders did not change their bids, DRS v1 could only increase the number of impressions sold, publisher revenues, and advertiser surplus."[664]

   a. Here, I note that the Weinberg Framework proposes that advertisers would bid their values, so advertiser surplus would stay exactly the same before and after DRSv1 rather than increase.

   b. Theorem 5 of the Milgrom Report states: "Suppose that a publisher is selling an impression to a fixed set of bidders on AdX. The publisher does not know each bidder's value for the impression, and bidders do not know each other's values for the impression, but all participants have the following information: (a) Each bidder knows its own value for the impression, (b) Each bidder's value is drawn from a commonly-known probability distribution and is statistically independent from other bidders' values, (c) Each bidder determines a bid as a function of its value to maximize its surplus from the impression, given its probabilistic assessments about the bids of other bidders. Then, if the publisher chooses revenue-maximizing floor

---

[663] For example, a seller selling an impression to a single advertiser whose value they believe to be uniformly distributed on [0,2] would optimally set a reserve of 1 with an opportunity cost of 0, and a reserve of 3/2 with an opportunity cost of 1.

[664] Expert Report of P. Milgrom, ¶429.

prices, it earns a higher expected revenue on an impression to which DRS v1 is applied than it would without the program, and advertisers' surplus is unchanged."665

c.   This theorem also has a hidden assumption, that the publisher understands the minimum revenue share DRSv1 will accept on this particular impression. This assumption is crucially used in the Milgrom Report's proof in the claim "If the publisher sets a floor price equal to r*/0.8 on an impression for which DRS v1 is active, the impression still sells to the highest bidder with value greater than the r*/0.8."666 In particular, in order for the publisher to set a floor price of r*/0.8, the publisher must know AdX's minimum take-rate (if it is 20%, the publisher should set a reserve of r*. If it is 0%, the publisher should set a reserve of r*/0.8).

   i.   Due to the mechanics of DRSv1, and in particular the throttling mechanic, it is not clear how a publisher would know the minimum take-rate AdX would accept on this particular impression, and therefore it is unclear how a publisher could set the prices as required for the Milgrom Report's proof.

d.   Therefore, Theorem 5 is irrelevant, as it requires the strong assumption "if the publisher chooses revenue-maximizing floor prices."667 The discussion above notes that this assumption is strong because it requires the publisher to be able to *induce DRSv1 to set the revenue-maximizing floor price*, which requires information obscured by DRSv1's throttling mechanism (and Google's concealing of DRSv1 itself).

497.   Theorem 7 of the Milgrom Report states: "Theorem 7: If publishers do not change their floor prices and buyers do not change their bids, then DRS v2 can only increase the total number of impressions sold and total publisher revenues compared to the absence of DRS."668

   a.   More importantly, it should be emphasized that *every additional impression sold and increased revenue due to DRSv2 occurs because a buyer pays more than their bid*. Further, the claimed benefit that Theorem 7 professes to show entails a significant cost to advertisers.

---

665 Expert Report of P. Milgrom, ¶433.

666 Expert Report of P. Milgrom, ¶649.

667 Expert Report of P. Milgrom, ¶433.

668 Expert Report of P. Milgrom, ¶444.

498. Theorem 8 of the Milgrom Report states: "If buyers and publishers set bids and floors to maximize their payoffs after the introduction of DRS v2, then buyer surplus and publisher revenues are the same as in the absence of DRS."[669]

    *a.* The Weinberg Opening Report states Theorem 8 as well.[670] This is the key theorem repeatedly cited in the Weinberg Opening Report when discussing deceptive aspects of DRSv2.

    b. The Milgrom Report states the following two paragraphs later: "In experiments conducted after the launch of DRS v2, Google found that DRS v2 led to a 2.8% net increase in total publisher revenues compared to no DRS, including revenue from remnant demand."[671] That is, publisher revenues *were not the same* as in the absence of no DRS.

    c. It logically follows to conclude that advertisers must not have set bids to optimize their payoffs under DRSv2, a conclusion cited in Sections IV. and V.

499. Prior to Theorem 9, the Milgrom Report states that tDRS satisfies three properties, and mistakenly draws an incorrect conclusion from these properties. Specifically, the Milgrom Report claims:

    a. "For any fixed floor price, more impressions would be sold with tDRS than without it."[672]

    b. "tDRS was bidder-truthful."[673]

    c. "On average, each publisher would receive its contracted share of the revenue."[674]

    d. The Milgrom Report then concludes "If publishers do not change their floor prices in response to tDRS, these three properties imply that tDRS would always increase publisher revenues from AdX compared to no DRS. This follows since bidding incentives were unchanged and more impressions were sold, so that the total revenue collected from bidders must increase, which, since the same average revenue share applied to the publisher, means that the publisher's total revenue

---

[669] Expert Report of P. Milgrom, ¶446.

[670] *See* Expert Report of M. Weinberg, ¶226.a ("If all advertisers responded optimally to DRSv2, no advertiser would bid in the dynamic region, and therefore DRSv2 would be equivalent to no DRS.".)

[671] Expert Report of P. Milgrom, ¶448.

[672] Expert Report of P. Milgrom, ¶452.a.

[673] Expert Report of P. Milgrom, ¶452.b.

[674] Expert Report of P. Milgrom, ¶452.c.

must also increase."[675] The following simple example shows why the Milgrom Report is incorrect:

i.  Consider two impressions for which the publisher sets a reserve of $8. For the first impression, there is a single bidder with a bid of $15. For the second impression, there are two bidders with a bid of $15.

ii.  With no DRS, AdX sets an effective reserve of $8/0.8 = $10 in both cases, and both impressions clear. The first impression clears at $10, from which AdX keeps $2 and passes on $8 to the publisher. The second impression clears at $15, from which AdX keeps $3 and passes on $12 to the publisher. The publisher's total revenue from these two transactions is $20.

iii.  With tDRS, AdX might think a reserve of $10 is too high,[676] and lower its minimum revenue share to 0% in both cases. For both impressions, this causes the buyers to face a second-price auction with effective reserve $8. The first impression now clears at $8 (instead of $10 with no DRS), and the publisher incurs a debt of $2. The second impression still clears at $15, from which AdX keeps $3 plus $2 to clear the publisher's debt for a total of $5 and passes on $10 to the publisher. The publisher's total revenue from the two transactions with tDRS is therefore $18, which is less than the $20 it earned with no DRS.

iv.  Therefore, this conclusion is false. The flawed logic arises because the assumption is that "publishers do not change their floor prices in response to tDRS,"[677] but the claim "more impressions were sold, so that the total revenue collected from bidders must increase,"[678] only follows if the effective reserve set by tDRS does not change. But indeed, the entire purpose of tDRS is to lower the effective reserve

---

[675] Expert Report of P. Milgrom, ¶453.

[676] Of course, if AdX *knew* there would be a bid of $15, AdX would not want to lower the reserve. But this is exactly the nature of truthful auctions: AdX does not *know* the bids before setting the reserve. For example, it could be that both AdX and the publisher both believe each bidder's value to be drawn independently and uniformly between [0,16], and the publisher has an outside option of $3.20 for the impression. Then the optimal reserve from AdX's perspective is $8, whereas the optimal reserve from the publisher's perspective optimizes (0.8*p-3.20)*Pr[buyer value exceeds p] = (0.8*p. -3.20)*(1-p/16.) The optimal solution is p = 10.

[677] Expert Report of P. Milgrom, ¶453.

[678] Expert Report of P. Milgrom, ¶453.

when publishers do not change their floor prices, so the effective reserve set by tDRS should change when publishers do not change their floor prices.

500. Theorem 9 of the Milgrom Report states: "If publishers adjust their floor prices on AdX to maximize profits after the introduction of tDRS and tDRS accurately predicts buyers' bids, total publisher revenues from all demand sources will be higher with tDRS than with a fixed revenue share."[679]

    a.    However, the implication that publishers could plausibly either "adjust their floor prices on AdX to maximize profits after the introduction of tDRS,"[680] nor even recognize that raising their price floors to 20% above desired would suffice is incorrect.[681] This is because tDRS was simply disclosed as "optimization feature,"[682] and due to the debt and throttling mechanisms, it is unclear how publishers could learn that tDRS was functionally lowering its price floors or when..[683]

    b.    In other words, Theorem 9 relies on flawed assumptions that render it irrelevant.

**D.    Responding to The Milgrom Report's Rebuttals.**

501. The Milgrom Report states: "Plaintiffs' experts allege that DRS harmed publishers by decreasing their revenue. Professor Gans focuses on DRS v2, stating "[t]he combined effects of Last Look and DRS v2 led to revenue losses for the publishers for the following reasons. When DRS v2 led to a decrease in the take rate to clear a binding price floor generated by Last

---

[679] Expert Report of P. Milgrom, ¶456.

[680] Expert Report of P. Milgrom, ¶456.

[681] The proof of Theorem 9 essentially observes that tDRS allows AdX to lower the publisher's reserve by up to 20%, so the publisher can just inflate their desired reserve by 20% to mitigate tDRS.

[682] GOOG-DOJ-AT-02424328 at -28.

[683] Professor Milgrom's report and a Google employee's deposition agree with this difficulty for advertiser debt – the same difficulty arises for publisher debt. *See* Expert Report of P. Milgrom, footnote 884 ("Another source of complexity under the first two versions of DRS was that, to optimize bids, a buyer would need to track performance across many auctions (ones on which revenue shares were discounted and others for which debt were repaid), making experiments by that buyer on subsets of impressions more difficult."); Deposition of Korula, Nitish, April 19, 2024, p. 316-7. ("Q. Well, is -- is -- is DRS either in version 1 -- I guess DRS version 2, would a buyer ever be able to observe if recollection has happened? A. I don't know that a buyer would be able to observe that it's happened on this query versus another query, but from the buyer's point of view they might be agnostic to that, right. They paid, you know, five dollars on one query and ten dollars on another query. If Google took a, you know, 19 percent revenue share on the ten dollar query and a 21 percent revenue share on the five dollar query, the publisher would get paid some amount so that's -- you know, the buyer doesn't necessarily observe how much went to the Google and how much went to the publisher on each individual query. Q. Okay. So, and then that -- and I think that's my question. I'm not ask if the buyer cares about the revenue share that Google takes. I'm asking if it's possible for the buyer to determine whether Google used this recollection mechanism. A. I don't believe it was possible for the buyer to observe that on any particular query. Ultimately they bid something. Google takes some share. The rest goes to the publisher, what they pay, what the buyer pays.")

Look, which is equal to the Header Bidding winning bid, the impression is awarded to AdX; the publisher gets paid only 1 cent higher than the Header Bidding winning bid."[684] The Milgrom Report continues by commenting on Professor Gans' example.

502. While Dr. Milgrom focuses on one example, he does not refute the underlying issues. The following is a *more concerning example* of the interaction between header bidding and *tDRS*.

    a. In this example, consider a Default Publisher in line with the Weinberg Framework. Default Publishers: (a) do not boost header bids because they set Value CPMs according to Google's suggested text/formula, and (b) would not change their price floors in response to tDRS, because they do not realize tDRS allows Google to lower their price floors.

    b. Imagine that both AdX and the publisher believe each advertiser to have a value equally likely to be anywhere in [0,16], independently. Imagine further that the publisher has a highest header bid in hand of $8, and sets this as the reserve for AdX.

    c. With no DRS, AdX would set a reserve of $10 for a fixed revenue share of 20%.[685] If the highest AdX bid is $9, the impression would fail to clear, and go to the highest header bid for $8.

    d. With tDRS, AdX would optimally choose to take a revenue share of 0% on this impression, which functionally lowers the publisher's price floor to $6.40 and sets AdX's reserve at $8.[686] If the highest AdX bid is $9, the impression would now clear on AdX at $8. AdX would pay the publisher $8 now, **but also generate $1.60 of debt**, so the publisher functionally receives $6.40*, even less than they had in hand from their header bid prior to calling AdX.* In other words, Google takes money from a future auction in order to clear an auction where Google's own fees would preclude a transaction.

    e. In comparison to the example in the Milgrom Report critiques:

        i. The outcome is the same – the publisher loses revenue compared to a header bid in hand due to DRS.

---

[684] Expert Report of P. Milgrom, ¶461.

[685] Because of the 20% revenue share, $10 is the lowest reserve AdX can set on its advertisers.

[686] Recall that, because of the debt mechanism, a publisher *always* received 80% of whatever revenue AdX brings in directly (assuming all debt clears.) So if the impression clears at $8, the publisher will get $6.40 after accounting for debt, even though the publisher set a price floor of $8.

ii.   The Milgrom's Report's first objection to the critiqued example is that it does not properly account for future debt recollection in DRSv2.[687] This critique does not apply to the above example, which fully accounts for all debt recollection in tDRS.

iii.  The Milgrom's Report's second objection is that the impression received a viable header bid in the first place.[688] This critique "applies" to the above example, but the point of this example is to demonstrate instances where DRS can harm publishers in surprising and deceptive manners, not to claim that tDRS always harms publishers. Moreover, note that DRS is always deceptive, even if this particular harm does not materialize on every impression.

iv.   The Milgrom's Report's[689] third critique "applies" to the above example, but this is the same debate regarding the Weinberg vs. Milgrom Framework, which I have already addressed extensively in Sections V. and VIII.

v.    In conclusion, this example (and the discussion elsewhere in this report) address all three of the Milgrom Report's objections.

503.  The Milgrom Report repeats Google's "disclosures" and further asserts "These claims of deception are contradicted by disclosures in the AdX Help Center starting from at least August 2015—before the launch of DRS v1."[690]

a.    Section IV. discusses the quality of these disclosures in, and disagrees that these disclosures "contradict my claims of deception."[691]

504.  The Milgrom Report further contends: "Professor Weinberg's claim that "[s]ince DRSv1 was not disclosed to the advertisers, they would still bid their true value for impressions" is doubly wrong, both because DRS v1 was disclosed and because buyers could quickly and easily detect its application. Every time DRS v1 affected a buyer's outcome, it caused the buyer to win an impression on which it had bid below the floor price and to pay the amount of its bid. Without DRS, that outcome was impossible. DRS leaves an unmistakable trace that can be detected

---

[687] *See* Expert Report of P. Milgrom, ¶462 ("his calculation of debt under DRS v2 is misleading.")

[688] *See* Expert Report of P. Milgrom, ¶462 ("he omits the more frequent case in which the floor price is one set by the publisher.")

[689] *See* Expert Report of P. Milgrom, ¶462 ("he omits the benefits when an optimizing publisher handles header bids correctly.")

[690] Expert Report of P. Milgrom, ¶468.

[691] Expert Report of P. Milgrom, ¶468 ("These claims of deception are contradicted by disclosures in the AdX Help Center.")

every time it reduces AdX's revenue share. A minimally attentive buyer who failed to read Google's disclosure could still discover DRS by noticing when a bid below the floor price was accepted at a price equal to its bid and, by applying logic or just conducting routine experiments, optimize its bidding strategy to account for that possibility."[692]

    a.    Section IV. notes that Google took efforts to prevent advertisers and publishers from discovering DRS, including through throttling.

    b.    Section IV. notes that no "minimally attentive buyers" seem to have detected DRSv1. This is supported by the fact that ███████████████████████ ██████████████████████████████████,[693] and that Google received no other inquiries regarding DRS as of 2016.[694]

    c.    Section IV. also poses one plausible explanation for this: Google's own "disclosure" is deceptive, and discourages "minimally attentive buyers" from acting on the discovery the Milgrom Report alleges by suggesting it is simply "due to auction optimizations."[695]

505. The Milgrom Report does not respond to arguments in my Opening Report regarding Google's misleading communications, nor arguments regarding DRSv2 being exceptionally misleading.

### E. The Milgrom Report does not provide convincing evidence of competitors using programs similar to DRS.

506. The Milgrom Report seems to excuse Google's Deceptive Conduct with respect to DRS by claiming that other exchanges "implemented similar programs" and cites █████████ ███████████ overview article.[696]

507. The key elements that are problematic with DRS are as follows:

---

[692] Expert Report of P. Milgrom, ¶469.

[693] ███████████████████████████████████████████████████████████████
███████████████████████████████████████████████████████████████
███████████████████████████

[694] GOOG-AT-MDL-B-006338037 at -37 ("Sent: 3/29/2016 [...] I am reaching out to you to ask if you have received or aware of external inquiries specific to these 2 features [DRS or RPO] [...] I am currently not aware of any additional external enquiries on the subject.")

[695] *See* Section IV. .

[696] ███████████████████████████████████████████████████████████████
███████████████████.

    a.    DRS induces a non-truthful auction when AdX claimed to be a second-price auction (DRSv1, DRSv2).

    b.    The debt mechanism obscures feedback given to advertisers and publishers (DRSv2, tDRS).

    c.    DRS allows AdX to charge an advertiser more than their bid after accounting for debt (DRSv2).

    d.    DRS allows AdX to pay a publisher less than their price floor after accounting for debt (tDRS, and to some extent DRSv2).

    e.    Google's communication surrounding DRS was deceptive, so none of the above properties were transparent to participants (DRSv1, DRSv2, tDRS).

508.   And one element that is key to DRS exacerbating conclusions regarding Google's other programs.

    a.    DRS enables AdX to transact more impressions than it otherwise would by varying its revenue share at the per impression level (DRSv1, DRSv2, tDRS).

509.   While no DRS variant satisfies all six elements, DRSv2 satisfies five, tDRS satisfies four, and DRSv1 satisfies three.

510.   █████████████████

    █████████████████████████████████████████████

    █████████████████████████████████████████████

511.   ███████████████

    █████████████████████████████████████████████

    █████████████████████████████████████████████

---

[697] Expert Report of P. Milgrom, ¶470 ("Non-Google exchanges ██████████████ implemented similar programs [to DRS].")

[698] Expert Report of P. Milgrom, ¶470 ("Non-Google exchanges ██████████ implemented similar programs [to DRS].")

512. When examining the overview article:[700]

    a.    The article cites Rubicon and PubMatic with sufficient detail to conclude they both varied their revenue shares at the per impression level.

    b.    There is not nearly sufficient detail to suspect any of the five problematic elements.

513. In summary, the Milgrom Report cites sufficient evidence to claim that multiple other exchanges adjusted revenue shares on a per-impression level in attempt to win more impressions. However, there is not sufficient evidence to conclude that their particular mechanisms have any of the problematic aspects that Google's DRS variants possess.

    a.    Again, there is nothing inherently objectionable about an ad server or exchange transparently adjusting price floors on a publisher's behalf. Rather, the particular mechanics by which Google implemented and communicated DRS are objectionable, and the Milgrom Report does not provide sufficient evidence to conclude these rival products are similarly problematic.[701]

    **F.**    **The Wiggins Report makes significant material mistakes implementing the DCMB Framework for DRSv1.**

514. When executing the DCMB Framework, the Wiggins Report concludes that "all AdX transactions where a Google Ads bid set the clearing price (regardless of whether Google Ads or another bidder won)" could not be affected in "(i) the clearing price, (ii) the winning bidder, (iii) whether the transaction cleared on AdX, or (iv) AdX's revenue share"[702] if only non-GDN advertisers shaded their bids, but GDN bids remained constant. Section IV. describes why this is relevant for the Wiggins Report's execution of the DCMB Framework. Below, is an example demonstrating a simple logical flaw in this claim.

---

[699] ████████████████████████████████████████████████████████████████████

[700] *See* Sarah Sluis, "Explainer: More On The Widespread Fee Practice Behind The Guardian's Lawsuit Vs. Rubicon Project," AdExchanger (Mar. 30, 2017), https://www.adexchanger.com/ad-exchange-news/explainer-widespread-fee-practice-behind-guardians-lawsuit-vs-rubicon-project/

[701] To clarify, there is simply a complete lack of evidence in this case – it is entirely possible that these programs are as deeply problematic as Google's, but evidence of this is not presented.

[702] Expert Report of S. Wiggins, ¶150.

515. Specifically, this is an example where: (a) a non-GDN bidder wins, (b) a GDN bidder sets the clearing price, and (c) if the non-GDN bidder were to bid-shade, this could change both (i) the clearing price, and (ii) the winning bidder.

516. Consider an example where the top non-GDN AdX bidder bids $12, the top GDN bidder bids $10, the AdX reserve is $8 (for everyone), and the second-top non-GDN bidder is $7.

   a.    Then in this example, the non-GDN bidder wins, and a GDN bidder sets the clearing price (of $10).

   b.    If the top non-GDN bidder were to bid-shade to $9, then the impression would clear at $9 instead of $10, and the GDN bidder would now win. So both the clearing price and winner have changed.

517. Therefore, the Wiggins Report's exclusion of such transactions as affected by DRSv1 is mistaken, as the above example shows. If one wishes to implement the "DCMB Framework", this mistake should be undone.

### G.    GDN and DV360's exemptions from RPO demonstrates preferential treatment.

518. The Milgrom Report notes, and Google documents confirm, that GDN and DV360 were both exempt from DRSv2.[703] This demonstrates preferential treatment towards Google's ad buying tools.

   a.    First, every advertiser would prefer to be exempt from DRSv2 if given the option. This is because DRSv2 can only cost advertisers who bid in the dynamic region. Without an exemption, advertisers are either stuck bidding in the dynamic region and paying more than their bid, or forced to do sophisticated experiments to learn to avoid the dynamic region.[704] This establishes that an exemption from DRSv2 is material and highly desirable for ad buying tools.

   b.    Second, internal Google emails describe the purpose of these exemptions as "GDN / DBM have auto-bidding models based on the assumption that for queries they win, the transaction price shouldn't be a function of their bid. DRS in its current form breaks that assumption."[705] This establishes that GDN and DV360 seek an

---

[703] GOOGTEX- 00831090 at -1 ("Sellside dynamic revenue share (DRS) is applied to AdX RTB but not Adwords or DBM."); Expert Report of P. Milgrom, footnote 343 ("DV360 and GDN were exempted from DRSv2.")

[704] Which ultimately appear to have been unsuccessful anyway, to the extent this was pursued – this is evidenced by the revenue lift of DRSv2 which could not have occurred without advertisers bidding in the dynamic region.

[705] GOOG-AT-MDL-B-002108440  at -40. This is supported by another internal Google emails. *See* GOOG-DOJ-14380727 at -27. ("I consider any flavor of DRS "compatible" with Bernanke and GDN/DBM optimization as long as GDN/DBM gets an opt-out. In your terminology, a flavor of DRS is "compatible" if GDN would be OK with it applying to its own bids, which is

exemption for exactly the same reason that any other ad buying tool would want an exemption.

c.    Therefore, the decision to exempt GDN and DV360 from DRSv2 but no other ad buying tools is a problematic example of disparate treatment. Moreover, it does not appear that Google provided an avenue for other ad buying tools to receive exemptions, even if they met the same criteria as "hav[ing] auto-bidding models based on the assumption that for queries they win, the transaction price shouldn't be a function of their bid." 706 Indeed, this is a natural property of an auto-bidding model that bids into AdX, as Google describes AdX as a truthful second-price auction.

### H.    Reaffirming the opinions concerning DRS in the Weinberg Opening Report.

519.    In my Opening Report, I make the following three claims:

    i.    **"Dynamic Revenue Sharing version 1 (DRSv1) increased AdX win rate and revenue and decreased non-AdX exchanges' win rates and revenues, compared to no DRS"**[707]

    ii.    **"Dynamic Revenue Sharing version 2 (DRSv2), in comparison to both no DRS and DRSv1, decreased advertiser payoff, increased AdX win rate and revenue, decreased non-AdX exchange's win rates and revenues, and may also decrease publisher revenue"**[708]

    iii.    **"tDRS would lead to an increase in AdX's revenue and win rate as compared to no DRS."**[709]

520.    The Milgrom Report responds "In fact, DRS applied predominantly to allow the sale of impressions where the publisher-set floor prices were too high to be met, rather than ones for which floor prices were determined by header bidding. 'eeking ahead at other exchanges' net

---

a much higher bar."); GOOG-DOJ-14271577 at -77 ("I'm trying to find a way to legitimately exclude AdWords. I don't think DRSv2 addresses that.")

[706] GOOG-AT-MDL-B-002108440  at -40. This is supported by another internal Google emails. *See* GOOG-DOJ-14380727 at -27. ("I consider any flavor of DRS "compatible" with Bernanke and GDN/DBM optimization as long as GDN/DBM gets an opt-out. In your terminology, a flavor of DRS is "compatible" if GDN would be OK with it applying to its own bids, which is a much higher bar."); GOOG-DOJ-14271577 at -77 ("I'm trying to find a way to legitimately exclude AdWords. I don't think DRSv2 addresses that.")

[707] Expert Report of M. Weinberg, ¶12.d.i.

[708] Expert Report of M. Weinberg, ¶12.d.ii.

[709] Expert Report of M. Weinberg, ¶223.

bids' was irrelevant in those cases, and DRS was output-expanding, allowing the sale of impressions that may not otherwise have been allocated and increasing AdX's win rate and publisher revenues without affecting the win rates or revenues of those other exchanges. In other cases, which were fewer in number, DRS allowed the publisher to increase the price it received for an impression above its best offer from header bidding (via the so-called 'last look'). DRS was an improvement in AdX's product offering that increased payments to publishers, reduced the number of unsold impressions (expanding output), and increased the total value of impressions won by AdX advertisers."[710]

521.  In other words, the Milgrom Report claims: (a) DRS predominantly allowed impressions to clear that otherwise would not have cleared (but still sometimes caused impressions to clear through AdX that otherwise would have cleared elsewhere), and (b) even in cases where DRS caused impressions to clear through AdX that otherwise would have cleared elsewhere, this improved publishers' revenue.

522.  Both of the Milgrom Report's claims are fully compatible with all aspects of the three claims present in my Opening Report. Specifically:

    i.    **These arguments are fully compatible (and even support) that all three DRS versions improved AdX win rate and revenue.**

    ii.    **These arguments establish that *in addition to* decreasing other exchanges' win rates and revenues, DRS also caused impressions to clear that otherwise would not have cleared. Therefore, the Milgrom Report's arguments are fully consistent with other exchanges losing win rate and revenue.**

    iii.    **These arguments do not address at all that DRSv2 decreased advertiser payoff (indeed, none of Google's experts address these claims).**

---

[710] Expert Report of P. Milgrom, ¶418. Professor Milgrom later expands "The evidence that I have reviewed suggests that these arguments omit DRS's main effects, which align with the program's stated purpose. Recall that DRS was intended to "[increase] publisher and Google revenue by dynamically changing the AdX sell-side revenue share so that more auctions end with a winning buyer" rather than going unsold. Internal Google experiments show that the most common effect of DRS was to cause an otherwise unmatched impression to be sold, rather than to win additional inventory off other exchanges. Clearing these impressions would increase AdX's win rate and publisher revenues, but would do so without affecting the win rates or revenues of those other exchanges." Expert Report of P. Milgrom, ¶458.

iv.  Finally, the opinion stated in the Weinberg Opening Report that DRSv2 "may also decrease publisher revenue." [711] is fully consistent with DRSv2 improving publisher revenue overall, and also the mechanisms the Milgrom Reports describes to improve revenue.

b.  Therefore, I maintain this opinion.

523.  "Google concealed information that is vital to advertisers and important to publishers by concealing DRSv1 from them."[712]

a.  The Weinberg Opening Report further states "Publishers would have set different reserve prices to maximize their revenues had Google revealed DRSv1."[713]

b.  The Milgrom Report responds "Plaintiffs' experts claim that buyers and publishers were unable to optimize their bids and floor prices because Google "misrepresent[ed] the sealed second-price auction." This claim is incorrect for two reasons. First, starting from at least August 2015—before the launch of DRS v1— Google publicly disclosed on the AdX Help Center page that AdX could adjust its revenue share on individual impressions. Second, buyers and publishers can experiment to improve their own outcomes regardless of what information they have about the auction."[714]

c.  The Milgrom Report in particular asserts that "A minimally attentive buyer who failed to read Google's disclosure could still discover DRS by noticing when a bid below the floor price was accepted at a price equal to its bid and, by applying logic

---

[711] Expert Report of M. Weinberg, ¶183.b.

[712] Expert Report of M. Weinberg, ¶12.d.iv.

[713] Expert Report of M. Weinberg, Section VII.D.1.

[714] Expert Report of P. Milgrom, ¶417. Professor Milgrom later expands "These claims of deception are contradicted by disclosures in the AdX Help Center starting from at least August 2015—before the launch of DRS v1. It says, "DoubleClick Ad Exchange determines the winning bidder based on the highest net bid submitted. Note that the net bid reflects any adjustments Ad Exchange may, at its discretion, have made to the bid submitted by the buyer for the purpose of optimizing the auction. [...] In some cases, the auction may close at a price lower than the reserve price applied, due to auction optimizations. Sellers are paid the Ad Exchange closing price, net of Google's revenue share, but will receive, subject to the terms governing their use of Ad Exchange, no less than the min CPM applied to the auction." Before the launch of DRS v2, the Help Center page was updated to include the possibility that some impressions would close above or below the contracted revenue share, while still ensuring that publishers would receive at least their contracted revenue share in a given month. Professor Weinberg's claim that "[s]ince DRSv1 was not disclosed to the advertisers, they would still bid their true value for impressions" is doubly wrong, both because DRS v1 was disclosed and because buyers could quickly and easily detect its application. Every time DRS v1 affected a buyer's outcome, it caused the buyer to win an impression on which it had bid below the floor price and to pay the amount of its bid. Without DRS, that outcome was impossible. DRS leaves an unmistakable trace that can be detected every time it reduces AdX's revenue share. A minimally attentive buyer who failed to read Google's disclosure could still discover DRS by noticing when a bid below the floor price was accepted at a price equal to its bid and, by applying logic or just conducting routine experiments, optimize its bidding strategy to account for that possibility." Expert Report of P. Milgrom, ¶468-469.

or just conducting routine experiments, optimize its bidding strategy to account for that possibility."715

    i.    As previously noted, Google recorded *zero* inquiries into DRSv1,716 despite the fact that ███████████████████████████████████████ .717 As also previously noted, Google's deceptive disclosure of DRSv1 might be one reason for this. In any case, the evidence makes clear that neither the "minimally attentive buyers [...] applying logic or just conducting routine experiments"718 the Milgrom Report references, nor the hyper-attentive buyers who are regularly testing exchanges for exactly the kind of behavior like DRSv1, detected DRSv1.

    d.    The Wiggins Report states "As described in Section II.B, as a general rule, both advertisers and publishers continually monitor performance and run experiments and other tests to optimize their strategies, often relying on other experienced intermediaries — such as advertising agencies, ad buying tools, and SSPs—to help them achieve the best results. Neither Mr. Andrien nor Professor Weinberg has provided any evidence that advertisers or publishers (or their intermediaries) focus on disclosed details about optimization features when developing and implementing their strategies."

    i.    This response *only* claims that an uninformative text "disclosure" would not influence advertiser behavior. This argument does not address how advertisers or publishers would have behaved if DRSv1 were transparently communicated.

    e.    The Wiggins Report further states "advertisers, with assistance from their ad buying tools and advertising agencies, would have continued to monitor returns, perform tests, and optimize their strategies to maximize returns regardless of whether DRS v1 was disclosed. [...] Similarly, as described in Section II.B, regardless of whether DRS v1 was disclosed, publishers would monitor their returns and optimize their

---

715 Expert Report of P. Milgrom, ¶469.

716 ███████████████████████████████████████████████████████████████████████████████████████████████

717 ███████████████████████████████████████████████████████████████

718 Expert Report of P. Milgrom, ¶469.

price floors based on the feedback they were constantly receiving as they participated in the auctions. Because both advertisers and publishers were likely engaging in the same strategies in both the actual and but-for worlds, Google's profits were likely the same in the actual and but-for worlds."

    i.  This is again a debate between the Weinberg Framework and the Milgrom Framework. Section V. justifies the Weinberg Framework as appropriate to evaluate the impact of Google's Deceptive Conduct, in large part due to Google's successful deception concealing DRS.

    f.  I therefore maintain this opinion.

524.  "DRSv1 is a dirty second-price auction and as a result, DRSv1 is not truthful."[719]

    a.  Google's experts do not contest this claim, and I therefore maintain this opinion.

525.  "At least some of Google's communication regarding DRSv2 was misleading"[720]

    a.  The Weinberg Opening Report states "For DRSv2, Google states: "Buyers are never charged more than their bid," I find this claim exceptionally misleading to advertisers."[721]

    b.  The Weinberg Opening Report states "For DRSv2, Google states: "sellers are always paid at least their reserve." I find this claim misleading to publishers."[722]

    c.  The Weinberg Opening Report states "Google states "Before or after the July change, we still do NOT pay publishers below publisher's floor…" I find this claim quite misleading to publishers concerning tDRS."[723]

    d.  Google's experts do not contest any of these claims, and I therefore maintain all of these opinions.[724]

526.  "DRSv1, DRSv2, and tDRS all naturally exacerbate all conclusions regarding non-AdX exchanges under Dynamic Allocation and Enhanced Dynamic Allocation."[725]

---

[719] Expert Report of M. Weinberg, ¶195.

[720] Expert Report of M. Weinberg, ¶183.c.

[721] Expert Report of M. Weinberg, ¶231.a.

[722] Expert Report of M. Weinberg, ¶231.b.

[723] Expert Report of M. Weinberg, ¶231.d.

[724] Google's experts implicitly seem to claim that Google's misleading communications are immaterial, because advertisers and publishers will figure it out anyway with routine experimentation. But, Google's experts do not object to my calling these communications misleading.

[725] Expert Report of M. Weinberg, ¶224.

    a.    Google's experts do not contest this claim, and I therefore maintain this opinion.[726]

527.  "DRSv1 was likely neutral to AdX advertisers' payoffs, although may have had some negative impact."[727]

    a.    "Advertisers would have submitted different bids to maximize their payoffs had Google revealed DRSv1"[728]

    b.    Google's experts do not contest this claim, and I therefore maintain this opinion.

528.  "DRSv2 led to a decrease in AdX advertisers' payoffs"[729]

    a.    The Weinberg Opening Report further states "DRSv2 was quite negative towards AdX advertisers' payoffs"[730]

    b.    The Weinberg Opening Report further states "If all advertisers responded optimally to DRSv2, no advertiser would bid in the dynamic region, and therefore DRSv2 would be equivalent to no DRS."[731]

    c.    The Weinberg Opening Report further states "No matter how an advertiser responds to DRSv2, they cannot possibly be better off than no DRS."[732]

    d.    The Weinberg Opening Report further states "Bid-shading in the dynamic region does not improve an advertiser's outcomes over truthful bidding, they must skip the dynamic region entirely in order to better respond to DRSv2 over truthful bidding."[733]

    e.    Google's experts contest none of these claims. Moreover, the Milgrom Report itself explicitly states the same conclusion "If all advertisers responded optimally to DRSv2, no advertiser would bid in the dynamic region, and therefore DRSv2 would be equivalent to no DRS"[734] as Theorem 8. Therefore, I maintain all of these opinions.

---

[726] Google's experts contest the conclusions I draw regarding DA and EDA, but do not contest that DRSv1, DRSv2, and tDRS would exacerbate them.

[727] Expert Report of M. Weinberg, ¶225.

[728] Expert Report of M. Weinberg, Section VII.F.2.

[729] Expert Report of M. Weinberg, Section VII.F.1.

[730] Expert Report of M. Weinberg, ¶226.

[731] Expert Report of M. Weinberg, ¶226.a.

[732] Expert Report of M. Weinberg, ¶226.b.

[733] Expert Report of M. Weinberg, ¶226.c.

[734] Expert Report of P. Milgrom, ¶661.

## XIII. APPLYING FIRST PRINCIPLES OF AUCTION THEORY, OPINIONS OF GOOGLE'S EXPERTS' REGARDING EXCHANGE BIDDING ARE INCORRECT.

529. After careful review of Google's experts' rebuttals, I still maintain all opinions in the Weinberg Opening Report concerning Exchange Bidding. In this section, I conclude the following.

    a.    First, it is my opinion that the Milgrom Report, the Wiggins Report, and the Baye Report all incorrectly evaluate the impact of Exchange Bidding.

    b.    Second, it is my opinion that the Milgrom Report's critiques about the Weinberg Opening Report are unfounded, do not affect the Weinberg Report's opinions, do not rebut the Weinberg Report's assertions, and are therefore irrelevant.

    c.    Third, contrary to the opinions of Google's experts, "header bidding improves publisher revenue and fill rate in comparison to the waterfall process."

    d.    Fourth, contrary to the opinions of Google's experts, "header bidding's auction mechanics generate higher revenue for publishers than Exchange Bidding's auction mechanics do."[735]

    e.    Fifth, contrary to the opinions of Google's experts, "[t]he auction mechanics of header bidding (without Enhanced Dynamic Allocation) would generate increased revenue for publishers, as compared to all exchanges participating in Exchange Bidding. Without (Enhanced) Dynamic Allocation, header bidding is a clean first-price auction with personalized reserves and low take-rate. Exchange Bidding is a clean first-price auction with personalized reserves (or non-personalized reserves, under UPR) where DFP collects a 5% take-rate on top of the ad exchange fee."[736]

530. Finally, contrary to the opinions of Google's experts, "[O]ne interpretation of Exchange Bidding is that it creates two tiers: Exchanges that participate in header bidding and exchanges that participate in Exchange Bidding together with AdX. [...] AdX and Exchange Bidding exchanges have a Last Look advantage over exchanges that participate in header bidding, but do not have a Last Look advantage over each other."[737]

### A.    Google's Experts Incorrectly Evaluate The Impact Of Exchange Bidding

531. It is my opinion that the Milgrom Report incorrectly asserts Google's shift to Exchange Bidding was beneficial to participants. The Milgrom Report asserts the shift was beneficial

---

[735] Expert Report of M. Weinberg, ¶150.

[736] Expert Report of M. Weinberg, ¶156.

[737] Expert Report of M. Weinberg, ¶161.

because it "eliminated the inefficiencies and confusions caused by differences in auction formats, and removed the so-called "last look" over header bidding. It reduced transaction costs both for both [sic] bidders (who no longer needed to bid differently in different exchanges) and publishers (who no longer needed to inflate header bids to set value CPMs for a second-price auction)."[738] There are three reasons why this assertion is incorrect.

    a.    First, despite Google's representations, Exchange Bidding still resulted in a Last Look advantage over Header Bidding.[739]

    b.    Second, even after Google shifted to Exchange Bidding, participants still needed to bid differently in different exchanges to achieve the same optimal outcomes because some exchanges were directly impacted by Google's Deceptive Conduct while others were not.

    c.    Third, even after the shift, publishers still needed to inflate header bids when setting Value CPMs in order to maximize revenue due to Exchange Bidding's Last Look advantage over header bidding.

## B.    The Milgrom Report's Critiques About The Weinberg Opening Report Are Irrelevant.

532.    The Milgrom Report attempts to rebut the Weinberg Opening Report by making several critiques to the report's assertion that Exchange Bidding has a Last Look advantage over Header Bidding.[740] [741] It is my opinion, based on Auction Theory and fact, that the Milgrom Report's critiques are irrelevant.

    a.    The Milgrom Report's first critique is that the Weinberg Report "understates the possibility that a publisher could boost a header bid before it serves as the floor price in the ad auction to reduce or even reverse any purported "advantage.""[742] But contrary to the Milgrom Report's critique, the Weinberg Opening Report acknowledges this possibility and explains why it is not relevant to that opinion. Further, after reviewing Milgrom Report and considering the critique, it is my

---

[738] Expert Report of P. Milgrom, ¶491.

[739] I identified this issue in my Opening Report.  *See* Expert Report of M. Weinberg, ¶161.

[740] *See* Expert Report of P. Milgrom, Section XII.D.5.

[741] Professor Milgrom's report also objects to other experts' characterization of a different Last Look advantage – these are distinct claims and objections.

[742] Expert Report of P. Milgrom, ¶515.

opinion, based on Auction Theory and fact, that it is more relevant to consider the impact of when publishers do not boost.[743]

    i.    The Milgrom Report's second critique is that the Weinberg Opening Report "offers no evidence that publishers did not respond to their very clear incentives to boost header bids and no explanation as to why publishers would not respond in that way."[744] It is my opinion, based on Auction Theory and fact, that the Milgrom Report's evidence in support of this critique does not actually support the critique; instead, it actually supports the Weinberg Opening Report's opinion.[745]

b.    The Milgrom Report's third critique of the Weinberg Opening Report's opinion, which addresses publisher revenue and exchange preferencing, is that publishers can make additional revenue with Last Look than without, because it encourages bidders to increase their bids, and thus the impact is not harmful and in fact beneficial to publishers.[746]

    i.    The Milgrom Report's example to support this critique has the following properties:

1)    A non-Google exchange submits a bid according to a first-price auction. AdX submits a bid according to a second-price auction.

2)    If AdX has a Last Look advantage over the non-Google exchange, the publisher sees increased revenue as compared to AdX submitting its second-price to compete with the non-Google first-price.

    ii.    It is my opinion, based on Auction Theory and fact, that this example is irrelevant for at least two reasons.

1)    First, it does not rebut the Weinberg Opening Report's assertion that Exchange Bidding still has a Last Look advantage over Header Bidding or explain why that does not impact

---

[743] Professor Milgrom's subsequent example therefore does not alter my opinion either – the example simply demonstrates that the Milgrom and Weinberg Frameworks lead to different conclusions, but I maintain my opinion that the Weinberg Framework is more relevant.

[744] Expert Report of P. Milgrom, ¶517.

[745] In fact, on balance I find the Milgrom Report's evidence to *better support the Weinberg Framework than the Milgrom Framework* ███████████████████████████████████████████████ )

[746] *See* Expert Report of P. Milgrom, ¶518.

participants.  The example only discusses the impact of Exchange Bidding and Last Look on publisher revenue rather than the overall impact on the exchange and all participants.

2)   Second, it does not consider that AdX could set its own reserve (using RPO, for example) to optimize its clearing price.[747]

c.   Additionally, the Milgrom Report's critiques all acknowledge that participants in Exchange Bidding had the same Last Look advantage over Header Bidding that AdX did, which further supports the Weinberg Opening Report's opinion that "[O]ne interpretation of Exchange Bidding is that it creates two tiers: Exchanges that participate in header bidding and exchanges that participate in Exchange Bidding together with AdX. [...] AdX and Exchange Bidding exchanges have a Last Look advantage over exchanges that participate in header bidding, but do not have a Last Look advantage over each other."[748]

### C.      Google's Experts' Opinions Support The Weinberg Opening Report's Opinions.

d.   The Milgrom Report states "Plaintiffs express concerns about the Open Bidding revenue share, but they fail to explain why a 5% revenue share is too much to charge for Google's Open Bidding services. For publishers, these services included reporting, payment processing, and integration with non-Google exchanges; for exchanges, they included real-time processing of the huge number of bids they submitted on each impression. Moreover, other non-Google header bidding services charge fees. For example, ███████████████████████ ████████████████████████. Internally, Google employees assessed that other exchange bidding tools charged revenue shares of between 5% and 10%. **Publishers who wished to avoid the Open Bidding revenue share could choose to use header bidding instead**."[749] (Emphasis added)

e.   It is my opinion, based in Auction Theory and in fact, that the above supports the Weinberg Opening Report's opinion about Exchange Bidding.  Further, it is my opinion, based in Auction

---

[747] Or, perhaps AdX could mimic the Alchemist by inserting a mincpm to optimize its clearing price on behalf of the winning advertiser. Or, perhaps AdX advertisers could create a second account to "second-price themselves" in order to get a more competitive clearing price. To be clear, I find both of these solutions sub-optimal, and I am not proposing them as counterfactuals for what Google AdX should have done in practice. I highlight them instead to demonstrate that the counterfactual of "non-Google exchange optimizes its bid but AdX does no optimization whatsoever" to be a less relevant counterfactual.

[748] Expert Report of M. Weinberg, ¶161.

[749] Expert Report of P. Milgrom, ¶498.

Theory and in fact, that to the extent that the Milgrom Report asserts the above to argue that the Weinberg Opening Report's assertion is not relevant, its assertion that publishers could just "choose to use header bidding instead" is misleading.  Under Exchange Bidding, AdX will always have a last look advantage over header bidding.  In light of AdX's Last Look advantage, if a publisher wishes to use AdX and another exchange, but does not wish give AdX a last look advantage over that exchange, the publisher must integrate that exchange through exchange bidding.

## XIV. APPLYING FIRST PRINCIPLES OF AUCTION THEORY, OPINIONS OF GOOGLE'S EXPERTS' REGARDING UNIFIED PRICING RULES ARE INCORRECT.

533.  After careful review of Google's experts' rebuttals, I still maintain all opinions in the Weinberg Opening Report concerning UPR. In this section, I respond to Google's experts' critiques pertaining to UPR.

534.  First, the Milgrom Report suggests that publishers have no need to set asymmetric reserves in simultaneous auctions, and AdX would only face a high reserve due to the sequential Waterfall. The Milgrom Report's claim is false – this section discusses why publishers still benefit from asymmetric reserves in simultaneous auction formats.

535.  Second, the Milgrom Report claims that UPR benefited publishers and advertisers by addressing self-competition. UPR would not meaningfully address self-competition and there are more direct approaches to do so.

536.  Third, this section provides evidence of an ulterior motive: to lower AdX reserves.

537.  Fourth, the Milgrom Report claims that because UFPA+UPR together improved publisher revenues, that UPR was good for publisher revenues. This is faulty logic, as it does not compare to the counterfactual of UFPA without UPR, and Auction Theory suggests that UPR would decrease publisher revenue as it decreases publisher choice.

538.  Fifth, the Milgrom Report claims that publishers do not need the ability to set different floors and can instead use post-auction discounts. While post-auction discounts provide publishers significant flexibility, they do not *subsume* asymmetric reserves. Therefore, UPR still reduces publisher choice even when considering post-auction discounts.

539. Sixth, the Milgrom Report notes that Meta's code of conduct requires UPR. If Google wishes to use Meta's code of conduct to defend UPR, Google should consider complying with the rest of Meta's code of conduct.[750]

540. Finally, this section concludes by reaffirming the following opinions from the Weinberg Opening Report.

a. "I demonstrate that UPR leads to lower revenue for the publishers."[751]

b. "I also demonstrate that UPR can lead to better win rate and revenue for Google's ad exchange AdX as well as for Google's ad buying tools and lower the win rate and revenue for rival exchanges and ad buying tools."[752]

i. "If AdX faced the highest personalized reserve pre-UPR, then AdX would transact more impressions and have increased revenue under UPR"[753]

ii. "Any exchange whose pre-UPR personalized reserve is lower than their UPR reserve would experience a lower yield and lower revenues under UPR, in comparison to the counterfactual of not imposing UPR on publishers."[754]

c. "[UPR] reduces publisher choice by preventing them from setting personalized reserve prices."[755]

i. "UPR prevents publishers from maximizing their revenues"[756]

d. "UPR can lead to inefficient outcomes"[757]

i. "UPR can lead to lower quality ads for the publishers"[758]

---

[750] And moreover, I note that none of my initial conclusions are affected by this anyway – my initial conclusions discuss the impact to auction participants of UPR, which still hold.

[751] Expert Report of M. Weinberg, ¶163.

[752] Expert Report of M. Weinberg, ¶163.

[753] Expert Report of M. Weinberg, ¶178.

[754] Expert Report of M. Weinberg, ¶179.

[755] Expert Report of M. Weinberg, ¶164.

[756] Expert Report of M. Weinberg, Section VI.B.1.

[757] Expert Report of M. Weinberg, Section VI.1.

[758] Expert Report of M. Weinberg, Section VI.B.2.

e.    "UPR would decrease the win rates and revenues of exchanges and ad buying tools that typically transact high quality ads"[759]

### A.    Different reserves optimize revenue in simultaneous auctions.

541.    The Milgrom Report states: "Before Google introduced the UFPA, publishers using GAM could improve both efficiency and revenue by setting different floor prices for bidders or demand sources depending on the order in which they were called. This important justification of setting different floor prices for different exchanges was eliminated in the UFPA, as discussed by Google engineers."[760] One reason to set different reserves is due to placement in a sequential auction format (as Professor Milgrom notes).[761]

542.    However, the Milgrom Report's assertion is also *misleading*, as it suggests there is no longer any need for publishers to set different reserve prices in a simultaneous auction format.[762] It is my opinion that even in a simultaneous auction format, revenue-maximizing publishers will want to set different reserves for several reasons:

a.    First, as I discuss in the Weinberg Opening Report, it is well-known that revenue-maximizing sellers benefit from *price discrimination* when setting prices for meaningfully different populations.[763]

b.    Second, if some exchanges tend to transact impressions of higher/lower quality, a utility-maximizing[764] seller would also want to set different reserves based on ad quality, even if the

---

[759] Expert Report of M. Weinberg, Section VI.C.2.

[760] Expert Report of P. Milgrom, ¶520.

[761] *See* Expert Report of P. Milgrom, ¶552 ("AdX would have faced a higher optimal floor price prior to the transition to UFPA-the sequential nature of the previous auction format.")

[762] *See* Expert Report of P. Milgrom, ¶520 ("This important justification of setting different floor prices for different exchanges was eliminated in the UFPA.") The Milgrom Report later explicitly states that there is no need for asymmetric reserves in a simultaneous format "These potential benefits of setting floor prices that differ by exchange are eliminated in the UFPA because bids from all exchanges are evaluated simultaneously and uniformly." (Expert Report of P. Milgrom, ¶550.) I disagree with this claim, as it only holds when the demand at each exchange is identical, *and* each exchange has identical conduct (i.e. neither does RPO, the Alchemist, etc.)

[763] *See* Expert Report of M. Weinberg, ¶166 ("Another reason why publishers may wish to set personalized reserves is that they might want to charge more to an exchange that tends to produce higher bids since these exchanges will generate higher revenue for the publishers.")

[764] I.e., revenue-maximizing while accounting for the impact of ad quality.

willingness-to-pay from the exchanges' populations are identical. The Weinberg Opening Report also discusses this concept.[765]

    c.    Third, even if quality *and* willingness-to-pay is identical across all exchanges, exchanges themselves engage in different Deceptive Conducts that may merit price discrimination. For example, GDN uses the Alchemist (which optimizes the bid submitted to AdX jointly on behalf of all GDN advertisers rather than individually for each GDN advertiser in isolation, and also boosts the winning bid before doing this optimization) only into AdX, so even if the underlying population of advertisers between AdX and non-Google exchanges are identical, the Alchemist makes it so that the bid distribution into AdX is meaningfully different.

543.    In summary, there are several strong, well-accepted motivations for price discrimination in simultaneous auction formats. While the additional motivation coming from a sequential format no longer exists, several strong motivations remain (and each of three reasons apply in the ad auction setting). Indeed, internal Google communication acknowledges these additional motivations.[766]

544.    The Milgrom Report repeats this flawed logic later, stating: "In asserting that if 'AdX faced the highest reserve pre-UPR, [then] UPR would naturally benefit Google's ad exchange AdX both in win rate and in revenue,' Professor Weinberg fails to account for the reason that AdX would have faced a higher optimal floor price prior to the transition to the UFPA—the sequential nature of the previous auction format."[767] The Milgrom Report, however, takes the quote in isolation and ignores the *entire section preceding*, which makes clear that the Weinberg Opening Report uses "pre-UPR" to mean "when optimized without UPR."[768] No text in the entire section suggests it might possibly use "pre-UPR" to mean "when AdX participated in a sequential Waterfall format."

---

[765] *See* Expert Report of M. Weinberg, ¶165 ("[T]here are several possible reasons why publishers might choose to set personalized reserve prices. First, they may wish to compensate for ad quality.")

[766] ████████████████████████████████████████████████████████████████

[767] Expert Report of P. Milgrom, ¶552.

[768] Expert Report of M. Weinberg, Section VI.

**B.      UPR does not meaningfully address self-competition.**

545.  The Milgrom Report proposes that a primary motivation for UPR is to address self-competition via price-fishing.[769] [770] "Self-competition" occurs when a multi-homing advertiser receives multiple calls for the same impression through different channels. Professor Milgrom uses the term "price-fishing" to mean "setting different floor prices for different exchanges" with the goals of "exploit[ing] this advertiser multi-homing."[771] The Milgrom Report can be interpreted to be drawing a distinction between "price-fishing" and routine *price discrimination* via the publisher's intent.[772]

546.  Importantly, self-competition is the meaningful outcome, and price-fishing is merely a tactic. Put another way, "protecting advertisers from [price-fishing]"[773] is successful *if and only if it protects advertisers from self-competition.* While UPR does prevent publishers from engaging in price-fishing by the letter (as publishers cannot set different floors on exchanges within Exchange Bidding), UPR does not meaningfully addresses self-competition.

547.  First, the Milgrom Report asserts that even with UPR, publishers can preference different exchanges via post-auction discounts or boosting header bids.[774] Therefore, even if a publisher technically sets the same reserve (of, say, $10) on all exchanges, different post-auction discounts (of, say, 50% for one exchange and 0% for another) would cause those exchanges to pass on a different reserve (of, say, $5 for the former and $10 for the latter) to their advertisers.

---

[769] Expert Report of P. Milgrom, ¶521 ("publishers could exploit this advertiser multi-homing through a tactic known as **price-fishing**: by setting different floor prices for different exchanges, a publisher could increase its revenue at the expense of such advertisers. Internal documents suggest Google was concerned about the possibility of price-fishing after the transition to the UFPA, and UPR protected advertisers from such tactics.")

[770] The Baye Report similarly proposes "UPR mitigated the effects of multi-calling and reduced self-competition." (See Expert Report of M. Baye, ¶89).

[771] Expert Report of P. Milgrom, ¶521.

[772] That is, "price discrimination" would set different reserves for different exchanges even if no advertiser multi-homed (because the publisher seeks to set different reserves for different advertiser populations), whereas "price-fishing" sets different reserves *because* advertisers multi-home.

[773] Expert Report of P. Milgrom, ¶521.

[774] *See* Expert Report of P. Milgrom, ¶524 ("But differential floor prices for different advertisers are still allowed under UPR and may be used to manage yield and filter lower quality ads. In addition, AdX also provides publishers several ways in which to control the quality and type of ads that can be displayed. Finally, publishers can and do use a more effective tool than differential floor prices to preference different exchanges, namely, post-auction discounts, which are contractual agreements made between publishers and exchanges or ad buyers to rebate a portion of winning bids."); Expert Report of P. Milgrom, ¶540("a publisher could favor a header bidding exchange by modifying the value CPMs on the line items used to represent that exchange's header bid. Inflating the value CPMs in that way would make the header bidding exchange more likely to be allocated the impression in the UFPA and would not increase the price for the impression paid by the header bidding exchange.")

Thus, the Milgrom Report admits that even if the publisher is not price-fishing by directly setting a different reserve on different exchanges, publishers can still effectively price-fish by setting a different post-auction discount. It is my opinion that even under the assumptions of the Milgrom report, the resulting concerns regarding self-competition are identical regardless of UPR.

548. Google's own engineers admit that UPR doesn't make self-competition less of a concern: At deposition, Google's buy-side corporate representative testified that "if you are submitting the same bid through two different exchanges, *whether the floors are equal or unequal*, I still see a version in which we have to be careful about a bid going to a different channel for the same opportunity."[775] [emphasis added] This suggests that self-competition is simply not addressed by UPR.

a.  The Milgrom Report disagrees, and instead states the following: "Consider an advertiser who receives two bid requests for an impression—one each from Exchange A and Exchange B— with the same floor price of $1.50 in a unified first-price auction. The bid requests might be for either the same impression or different impressions that happen to have the same floor price, but the advertiser's bidding strategy is the same regardless: **bids as it would in a standard first-price auction (as analyzed in Section III.C.3.b) with a floor price of $1.50.** For example, if the advertiser estimates that there are no other advertisers competing for the impression, then the advertiser would optimally place a bid in each exchange that just beats the floor price of $1.50 in either case, which is just the same as if there were no self-competition."[776] (emphasis added).

b.  I disagree with the Milgrom Report. Indeed, the emphasized phrase implies that the advertiser has a single strategy for "a standard first-price auction with a floor price of $1.50" that somehow does not depend on: (a) the advertiser's value for that impression, (b) the advertiser's beliefs about other bids for that impression, nor (c) the mechanics of the particular exchange (whether it uses RPO to adjust your future reserves based on this bid, for example). That is, just because two distinct impressions have the same floor *does not imply* that an advertiser should bid the same for those two impressions. Therefore, two impressions having the same

---

[775] Deposition of N. Jayaram, p. 543.

[776] Expert Report of P. Milgrom, ¶530.

floor does not simplify the bidding process for those two impressions without knowing whether or not they are distinct, and UPR does not meaningfully address self-competition.

549. Finally, there are simply more direct methods to solve self-competition, such as Global Placement IDs, which help with inventory identification by tagging each impression with a unique identifier code.[777]

550. For these reasons, UPR does not meaningfully address self-competition.

### C.    Evidence that UPR was self-serving.

551. The Milgrom Report attempts to show that Google's introduction of UPR was strictly for the benefit of publishers, and not to benefit Google.[778] But internal Google communications illustrate Google's self-interested motivations.

552. In particular, a Google employee writes (when discussing UPR) "The presence of per demand floors really hurts us and has been one of the biggest challenges for AdX as a platform vs some of the other exchanges. So the team definitely wants to address it."[779] Another writes (when discussing UPR) "Pubs have traditionally been deliberate about setting higher floors for AdX in general, and *GDN/DBM* in particular. A lot of this is to employ specific yield management strategies to close out the auction discount between the buyer's bids and the transaction price in the second price auction."[780] (emphasis added).

553. It is my opinion that these statements by Google employees illustrate that Google intended for UPR to lower Google's own reserves, even though Google understood that publishers would

---

[777] Prebid, "Prebid Ad Slot and the GPID", available at: https://docs.prebid.org/features/pbAdSlot.html ("The Global Placement ID (GPID) was an initiative in the Fall of 2021 led by the TradeDesk to solve the problem of inventory identification in an industry-wide way. i.e. Buyers want to be able to identify ad slots in a unique way even when the publisher uses the same ad slot name multiple times."); AdExchanger, "Attack Of The Clones: Programmatic's Hidden Scourge Of Bid Duplication." Available at: https://www.adexchanger.com/platforms/attack-of-the-clones-programmatics-hidden-scourge-of-bid-duplication/ ("Of the two largest DSPs, The Trade Desk has been most vocal on the policy front. It wants SSPs to start using its Global Placement IDs (GPIDs), which would help deduplicate impressions.") This is not to imply that self-competition is an easy or solved problem – I am merely noting that it is a studied problem with more direct solutions that attempt to directly match identical impressions.

[778] *See* Expert Report of P. Milgrom, ¶522 ("First, it simplified the publisher's process of setting floor prices applying to both Google and non-Google buyers using Open Bidding. Instead of setting floor prices separately using each exchange's interface, a publisher needs to set just one UPR floor in GAM. Second, it mitigated an externality that would reduce the revenues of all publishers, arising when a multi-homing advertiser faced with price-fishing publishers finds it difficult to coordinate its many bids and is incentivized to reduce its bids or not bid at all on some impressions.")

[779] GOOG-DOJ-AT-00569648 at -48.

[780] GOOG-DOJ-12948968 at -68. Note that while AdX no longer ran a second-price auction, the same "auction discount" applies when lax reserves enable an advertiser to aggressively bid shade.

extract more revenue by setting a higher reserve on AdX (due to GDN/DBM/AdX mechanics). My opinion is supported by the writing of another Google employee, who proposed to keep UPR bundled with the UFPA announcement because: "doing [UPR] at any later time (especially after announcing it) has 2 big challenges: 1. Doing this by itself makes it look extremely self serving 2. If we go back now we send clear indication that we are not sure this is the right thing to do and bringing it back later will be non trivial I think."[781] In other words, Google itself recognized that UPR served Google's interests.

554. In summary, these internal documents suggest the possibility that at least one of Google's objectives with UPR is the self-serving objective of lowering AdX price floors.

### D.    The Milgrom Report's evidence does not demonstrate UPR benefited publishers.

555. The Milgrom Report states "Plaintiffs and their experts fail to acknowledge the benefits **of UPR** to advertisers and publishers. A few months after the introduction of **the UFPA and UPR**, Google found that both total publisher revenues and the share of impressions allocated to non-Google exchanges increased. Post-launch experiments found that **the combined effect of UFPA and UPR** was approximately neutral on publisher revenues and an improvement in revenues for non-Google DSPs buying via AdX."[782] (emphasis added)

556. It is my opinion that the Milgrom Report failed to provide evidence to support its conclusion. While the Milgrom Report asserts that there are "benefits of UPR to advertisers and publishers," it only analyzes *the combined effect of UFPA and UPR*. The Milgrom Report's failure to isolate the effects of UPR from the combined effects with UFPA is a methodological failure that stains its conclusions.

557. It is my opinion that because UPR restricts publisher choice, UPR would be expected to decrease publisher revenues. The only argument the Milgrom Report provides that may counter this opinion is that UPR perhaps avoids a tragedy of the commons caused by price-fishing.[783] However, as previously stated, UPR is an ineffective tool to address price-fishing .

---

[781] GOOG-DOJ-AT-00569648 at -48 and -49. Moreover, this was stated in response to an email cited in Professor Milgrom's report. GOOG-DOJ-06732979, at -980 ("We know that these knobs become less useful/impactful in the first-price auction. So even if we keep them they will become ineffective and the usage should trend down in the coming months.")

[782] Expert Report of P. Milgrom, ¶523.

[783] *See* Expert Report of P. Milgrom, ¶537 ("By protecting advertisers from price-fishing, UPR also benefited publishers. Although individual publishers might be incentivized to engage in price-fishing tactics, advertisers might end up bidding less

558. In summary, the Milgrom Report does not provide supporting evidence that UPR benefited publishers. The Milgrom Report failed to separate the effects of UFPA from UPR, and instead asserts without basis that all positive effects are the result of UPR. Finally, the Milgrom Report's "tragedy of the commons" counterargument is belied by the evidence that UPR was ineffective at addressing price fishing.

### E.    Even with Post-Auction Discounts, UPR still restricts publisher choice.

559. The Milgrom Report states: "publishers could also favor certain exchanges or advertisers by offering them post-auction discounts. Post-auction discounts are contractual agreements between publishers and ad buyers and exchanges, in which the publisher agrees to rebate a fraction of the winning bids made by the ad buyer or exchange after the auction has concluded."[784] The Milgrom Report further states:

> **In an auction, post-auction discounts are usually a better tool for publishers than differential floor prices. In theory, when bidders are asymmetric in their willingness to pay or in their quality, then an optimal handicapping process causes different bidders to be charged different prices when they win. Appropriately designed post-auction discounts can often approximate the optimal process, while exchange-discriminatory floor prices, which use the same prices for any winning bidder whose bid exceeds its floor, cannot generally approximate the optimal mechanism.[785]**

560. This discussion will focus only on the mathematical manners by which post-auction discounts and reserve prices modify an auction format, and not comment on the relative complexity of implementing a post-auction discount versus setting reserves.

561. The Milgrom Report establishes *an example* where a post-auction discount outperforms asymmetric reserves.[786] However, *post-auction discounts do not subsume asymmetric reserves*.

---

on *all* impressions, which in turn could end up harming *all* publishers. This is a well-known economic phenomenon akin to the *tragedy of the commons*: price-fishing publishers impose an *externality* that harms advertisers and other publishers. By preventing publishers from engaging in that type of gamesmanship, UPR protected advertisers and publishers that were not price-fishing.")

[784] Expert Report of P. Milgrom, ¶541.

[785] Expert Report of P. Milgrom, ¶543.

[786] I also note that the Milgrom Report's example requires the publisher to give a per-impression post-auction discount (i.e. $2 per impression), whereas the definition he provides and the sources he cites describe post-auction discounts as *fractions* of

That is, a publisher who wishes to truly run a first-price auction with reserve $1 for one exchange and $2 for another exchange cannot accomplish this with a post-auction discount.

562. Therefore, although the Milgrom Report provides an example where a publisher could improve upon asymmetric reserves with post-auction discounts, UPR still reduces publisher flexibility even with the possibility of post-auction discounts.

### F.    If Google defends UPR via third-party "codes of conduct", it should respect the entire code.

563. The Milgrom Report claims that UPR is considered a "best practice" by Xandr and Meta's "code of conduct."[787] Xandr's "best practices" indeed suggest UPR, and Meta's "code of conduct" requires it. However:

564. Google relies on Meta's code of conduct to justify UPR while at the same time disregarding its other provisions. For example:

a.    "Auction logic and methodology should be transparent and disclosed to all parties in writing prior to commencement of a commercial relationship. Future material changes to auction logic must be disclosed to all parties with adequate explanation and anticipated impact or outcome."[788]

i.    Google never disclosed Project Bernanke. Moreover, Google did not disclose RPO or DRS "with adequate explanation and anticipated impact or outcome."

b.    "Tech should not prioritize or favor any impression opportunity or bid from any demand source, including the Tech's own demand, other than based on the highest bid. Tech should not run any secondary auctions and should not use bids as a floor to be entered into a secondary auction for the same ad opportunity." [789]

---

payments (i.e. 10%.) *See* Expert Report of P. Milgrom, ¶541 ("Post-auction discounts are contractual agreements between publishers and ad buyers and exchanges, in which the publisher agrees to rebate a fraction of the winning bids made by the ad buyer or exchange after the auction has concluded.");                                              ")

[787]  Expert Report of P. Milgrom, ¶545.

[788] Meta Audience Network, "Code of Conduct." Available at: https://www.facebook.com/audiencenetwork/partner-program/code-of-conduct

[789] Meta Audience Network, "Code of Conduct." Available at: https://www.facebook.com/audiencenetwork/partner-program/code-of-conduct

i.     Dynamic Allocation is a secondary auction that uses Header Bids as a floor for the same ad opportunity. Moreover, it favors bids from AdX over other exchanges.

c.     "Tech should provide a mechanism for publishers and demand sources to validate technical transparency and auction logic, which may include a third-party audit." [790]

i.     I am not aware of any such mechanism for Google's products. Moreover, Google responded to ████████████ inquiries regarding DRSv2 and RPO with deception rather than transparency.

d.     "Publishers have ultimate control over priorities, order and bidding logic, including but not limited to calling direct sold inventory separately from auctioned supply, setting a price floor, or for any other reason. Such inventory is explicitly out of scope of the intention of this program. Further, nothing herein shall be misconstrued to impact basic ad serving." [791]

i.     Google launched EDA without a transparent opt-out, which removes publisher control to separate direct sold from auctioned supply.[792] DA prevented publishers from freely ordering exchanges in the Waterfall. tDRS (and to some extent, DRSv2) overrode publisher's price floors and sometimes paid less than their price floor.

e.     "Tech should not use last look or any other practice which uses bids submitted by any other party to calculate or optimize its own bids." [793]

i.     AdX and Exchange Bidders *still* have a Last Look advantage over Header Bidders.

f.     "Reserve price mechanism should not be updated dynamically at request time (ex. soft floors)." [794]

---

[790] Meta Audience Network, "Code of Conduct." Available at: https://www.facebook.com/audiencenetwork/partner-program/code-of-conduct

[791] Meta Audience Network, "Code of Conduct." Available at: https://www.facebook.com/audiencenetwork/partner-program/code-of-conduct

[792] *See* GOOG-DOJ-14141075 at -76 ("The default is EDA on, all new networks have it on. It can be turned off in ICS, but we don't want to mention it as an option.")

[793] Meta Audience Network, "Code of Conduct." Available at: https://www.facebook.com/audiencenetwork/partner-program/code-of-conduct

[794] Meta Audience Network, "Code of Conduct." Available at: https://www.facebook.com/audiencenetwork/partner-program/code-of-conduct

i.      DRSv1 and Project Bernanke[795] both did exactly this.

565.   Moreover, whether UPR is ultimately a "best practice" in Google's Display Advertising RTB Ecosystem does not impact any of my conclusions, which concern only the impact of UPR on auction participants.

### G.      Reaffirming my opinions concerning UPR.

566.   "I also demonstrate that UPR can lead to better win rate and revenue for Google's ad exchange AdX as well as for Google's ad buying tools and lower the win rate and revenue for rival exchanges and ad buying tools."[796]

a.      The Weinberg Opening Report further states "If AdX faced the highest personalized reserve pre-UPR, then AdX would transact more impressions and have increased revenue under UPR"[797]

b.      The Weinberg Opening Report further states "Any exchange whose pre-UPR personalized reserve is lower than their UPR reserve would experience a lower yield and lower revenues under UPR, in comparison to the counterfactual of not imposing UPR on publishers."[798]

c.      The Milgrom Report responds "In asserting that if "AdX faced the highest reserve pre-UPR, [then] UPR would naturally benefit Google's ad exchange AdX both in win rate and in revenue," Professor Weinberg fails to account for the reason that AdX would have faced a higher optimal floor price prior to the transition to the UFPA—the sequential nature of the previous auction format. Even if a publisher rationally set higher floor prices for AdX before the UFPA, one cannot assume (as Professor Weinberg does) that it would be optimal for AdX to face a higher floor price after the transition to the UFPA."[799]

d.      Section VI. describes how the Milgrom Report misrepresents the claim in the Weinberg Opening Report – the *entire section preceding this quote* makes abundantly clear that the Weinberg Opening Report uses "pre-UPR" to mean "when optimized without UPR". No text

---

[795] During periods when Project Bernanke used a first-price payment rule.

[796] Expert Report of M. Weinberg, ¶163.

[797] Expert Report of M. Weinberg, ¶178.

[798] Expert Report of M. Weinberg, ¶179.

[799] Expert Report of P. Milgrom, ¶552.

in the entire section suggests it might possibly use "pre-UPR" to mean "when AdX participated in a sequential Waterfall format." Therefore, this argument from the Milgrom Report is to a claim that was never made.

e.   Google's experts do not rebut the claim made in the Weinberg Opening Report (that an exchange with the highest reserve under personalized prices would face a lower reserve with UPR). Google's experts also do not address the second claim in the Weinberg Opening Report (that exchanges with pre-UPR personalized reserve would have lower yield and lower revenue under UPR). Therefore, I maintain both of these specific opinions, as well as the overarching opinion they support.

567.   "I demonstrate that UPR leads to lower revenue for the publishers."[800]

568.   "[UPR] reduces publisher choice by preventing them from setting personalized reserve prices."[801]

a.   The Weinberg Opening Report also states "UPR prevents publishers from maximizing their revenues"[802]

b.   The Weinberg Opening Report demonstrate three manners by which UPR reduces publisher choice.

c.   First, the Weinberg Opening Report states "For new advertisers, or advertisers with whom the publisher has not interacted enough to be able to set a suitable reserve price, publishers would rely on coarse information to set appropriate reserves. For example, advertisers that choose to transact through AdX may tend to be materially different (both in willingness to pay and in ad quality) than advertisers who chose to transact through non-Google exchanges. In order to maximize revenue, publishers would still want to set as good a reserve as possible on new advertisers for whom they have not yet decided on an appropriate advertiser-specific reserve. The natural mechanism by which to do this is to set a single personalized reserve on AdX (or the non-Google exchanges) that applies to all advertisers, including new ones, who transact through AdX. Note that the ability to set personalized reserves to advertisers does not address

---

[800] Expert Report of M. Weinberg, ¶163.

[801] Expert Report of M. Weinberg, ¶164.

[802] Expert Report of M. Weinberg, Section VI.B.1.

this source of revenue loss since per-advertiser reserves are only meaningful with sufficient information about the advertiser, whereas a per exchange reserves are necessary to maximize revenues based on available information on new advertisers."[803]

d.  Next, the Weinberg Opening Report states "Even when the advertiser is known to the publisher, publisher revenue can depend on the exchange through which that advertiser's bid occurred. The same advertiser's initial bid is processed differently through AdX than non-Google exchanges. Therefore, a revenue-maximizing publisher would naturally want to set different reserves for exchanges that engage in different conducts, even if they reach the same advertiser pool." [804]

e.  Finally, the Weinberg Opening Report states "Finally, even when the advertiser is known to the publisher, and that advertiser is known to transact through exactly one exchange, the '200 Rules' limit that comes with UPR would still lead to revenue loss among publishers because it prevents the implementation of revenue-maximizing strategies that use personalized reserves. When there are many advertisers potentially interested in an impression, revenue-maximization requires a granular reserve for each advertiser, as explained above. Limiting the number of allowed reserve prices to 200 limits the publisher's ability to maximize revenues." [805]

f.  The Milgrom Report responds to the first two claims by proposing post-auction discounts in place of personalized prices.[806]

---

[803] Expert Report of M. Weinberg, ¶171.a.

[804] Expert Report of M. Weinberg, ¶171.b.

[805] Expert Report of M. Weinberg, ¶171.c.

[806] The Milgrom Report states "Yet, Plaintiffs and their experts fail to mention that publishers had access to more effective tools to achieve these same objectives if the need arose. For example, a publisher wishing to preference a non-Google exchange "to diversify the sources of demand for their inventory" or to "combat problems of adverse selection" could do so by providing a post-auction discount (as discussed in Section XIV.D) or (for header bidding exchanges) by modifying the value CPMs on the line items used to represent that exchange's header bid. Either of these adjustments would lead the favored demand source to win a larger share of the impressions." (Expert Report of P. Milgrom, ¶553-554.) And also ""Plaintiffs and their experts also claim that setting exchange-specific price floors could increase the publisher's revenue when the distribution of bidder values differs across the exchanges. Professor Weinberg illustrates his claim with the following example: "imagine that there is a single AdX bidder whose value is distributed uniformly on [12,16], and there is a single OpenX bidder whose value is distributed uniformly on [10,12]. In this case, the revenue-optimal personalized reserves are $13 on AdX and $10 on OpenX."1101 I show in the technical notes in Section XV.F that the publisher can do even better using a uniform reserve price of $12 and a $2 post-auction discount for OpenX. The proper lesson from Professor Weinberg's example is that differences in values can be better managed by post-auction discounts, such as I have described in my published work, rather than by non-uniform reserves." (Expert Report of P. Milgrom, ¶558)

i.    Post-auction discounts do not *subsume* personalized prices, and therefore publishers still lose flexibility under UPR.

g.    The Milgrom Report responds to the final claim by proposing that "200 rules" is sufficient, and that in any case ███████████████████████████.[807] [808] [809]

h.    Because the first two claims are addressed only by reference to post-auction discounts, and UPR still restricts publisher choice even with post-auction discounts, I maintain my opinions that UPR leads to lower revenue for publishers, reduces publisher choice by preventing them from setting personalized reserve prices, and prevents publishers from maximizing their revenues.

569.    "UPR can lead to inefficient outcomes"[810]

a.    The Weinberg Opening Report further states "UPR can lead to lower quality ads for the publishers"[811]

b.    The Milgrom Report proposes two alternate mechanics to address ad quality. First, he proposes tools to filter inappropriate ads entirely.[812] This approach would be inappropriate for an

_____

[807] *See* Expert Report of P. Milgrom, ¶560 ("This is wrong in several ways. First, as a practical matter, advertisers can be usefully categorized into groups, making it unnecessary to set a separate rule for each advertiser. Second, "pricing rules" are different from "price floors": publishers can "specify up to 50 advertisers per pricing rule," which in principle allows specific floor prices for up to 10,000 advertisers. ███████████████████████."); Expert Report of P. Milgrom, ¶561 ("Google also demonstrated responsiveness to advertiser concerns about the limits. Based on publisher feedback that 100 rules would be too limiting, Google "increas[ed] the maximum number of pricing rules" to 200 when the UFPA with UPR was fully launched. I have not seen any evidence of widespread demand for Google to increase the 200-rule limit further.")

[808] ████████████████████████████████████████████████████████████████████

[809] The Baye Report similarly states "UPR allowed implementation of up to 200 unique price rules, and each price rule could include up to 50 advertisers, leading to the possibility of 10,000 advertiser-specific floors. Recent auction-level data are inconsistent with Plaintiffs' theory that the limit of 200 price floors was an important constraint for many publishers. Google's auction-level data indicate that 40 percent of publishers had fewer than 20 floors and the "median" publisher used fewer than 200 floors."

[810] Expert Report of M. Weinberg, Section VI.1.

[811] Expert Report of M. Weinberg, Section VI.B.2.

[812] *See* Expert Report of P. Milgrom, ¶555 ("A publisher wishing to address ad quality concerns also has more direct tools than exchange-discriminatory floor prices. Professor Pathak offers as an "example, a website that publishes stories for children would want to refrain from showing ads related to tobacco or alcohol products." Firstly, GAM prohibits non-age appropriate ads from being shown to teens and children, and ads for alcohol and tobacco products are even more broadly restricted. In addition, advertisers "can mark [their] ad requests to be treated as child-directed. The feature is designed to help facilitate compliance with the Children's Online Privacy Protection Act (COPPA.)" More broadly, GAM makes ad content protection features available to all publishers, allowing them to avoid presenting ads with sensitive content, ads from specific buyers, or ads in general categories such as "Apparel, Finance, and Health." Finally, GAM also allows publishers to set category specific floor prices for the sensitive categories.")

advertiser who is willing to show low quality ads, but at a higher price (or who cannot specify with a category the ads they consider to be low quality). Second, the Milgrom Report proposes to set advertiser-specific floor prices. This latter approach makes sense only for advertisers with whom the publisher previously has substantial interaction.[813] For new advertisers, or advertisers with whom the publisher has not yet had substantial interaction, the publisher can only rely on coarse information (such as the exchange through which the advertiser transacts).

c.    I therefore do not believe the Milgrom Report's solutions obviate the benefits of personalized prices to control for ad quality, and maintain this opinion.

570.  "UPR would decrease the win rates and revenues of exchanges and ad buying tools that typically transact high quality ads"[814]

a.    The Milgrom Report responds with "As discussed in Section XIV.D, publishers could also use post-auction discounts to favor specific exchanges or advertisers with higher-quality ads."[815]

b.    Again, because post-auction discounts do not subsume personalized pricing, personalized pricing still offers publishers flexibility (including those who use post-auction discounts). I therefore maintain this opinion.

---

[813] Expert Report of P. Milgrom, ¶556 ("Publishers could also set advertiser-specific floor prices to address ad quality concerns from specific advertisers. Advertiser-specific floor prices would be more effective than exchange-discriminatory floor prices due to the prevalence of advertiser multi-homing. When a publisher raises the floor price of a DSP, any low-quality advertisers using that DSP would have an incentive to move their campaigns to another DSP. Only by setting high floor prices for that advertiser across all exchanges could a publisher effectively block ads from that advertiser.")

[814] Expert Report of M. Weinberg, Section VI.C.2.

[815] Expert Report of P. Milgrom, ¶556.

APPENDIX A. CIRRICULUM VITAE

## S. MATTHEW WEINBERG

---

| CONTACT<br>INFORMATION | 231 South Stanworth Dr.<br>Princeton, NJ 08540 | *Cell:* +1 (571)-278-3990<br>*E-mail:* smweinberg@princeton.edu |
|---|---|---|

| RESEARCH<br>INTERESTS | Algorithmic Mechanism Design, Algorithms and Uncertainty, Mechanism Design for Blockchain Applications. |
|---|---|

### EMPLOYMENT

| Spring 2017 - Present | **Princeton University** | **Princeton, NJ** |
|---|---|---|
| | Associate Professor, with tenure (2023 - present).<br>Assistant Professor (2017 - 2023).<br>Instructor for COS445: Economics and Computation (Spring 2017, Spring 2018, Spring 2019, Spring 2020, Spring 2021, Spring 2022, Spring 2023, Spring 2024).<br>Instructor for COS521: Advanced Algorithms (Fall 2017, Fall 2019, Fall 2021, Fall 2022).<br>Instructor for COS597F: Open Problems in Algorithmic Game Theory (Fall 2018).<br>Instructor for COS597A: Advanced Topics in Computer Science: Algorithmic Mechanism Design for Cryptocurrencies and DeFi (Fall 2022). | |

| Fall 2014 - Spring 2016 | **Princeton University** | **Princeton, NJ** |
|---|---|---|
| | Postdoctoral Researcher.<br>Instructor for COS597A: Algorithmic Mechanism Design (Fall 2014). | |

### EDUCATION

| 2010 - 2014 | **Massachusetts Institute of Technology** | **Cambridge, MA** |
|---|---|---|
| | Ph.D., Computer Science | |
| | Adviser: Constantinos Daskalakis<br>Thesis: Algorithms for Strategic Agents<br>Teaching Assistant for 6.046: Design and Analysis of Algorithms (Spring 2013).<br>Teaching Assistant for 6.853: Topics in Algorithmic Game Theory (Fall 2011). | |

| 2006 - 2010 | **Cornell University** | **Ithaca, NY** |
|---|---|---|
| | B.A., Mathematics | |
| | GPA: 4.038/4.3<br>Magna Cum Laude<br>Teaching Assistant for CS 4820: Introduction to Analysis of Algorithms.<br>Teaching Assistant for CS 2800: Discrete Structures. | |

Consultant for CS 2110: Object Oriented Programming and Data Structures.

Consultant for CS 100J: Introduction to Programming using Java

GRANTS AND
AWARDS

| | |
|---|---|
| 2022 | **FOCS Test of Time Award.** For "Optimal Multi-Dimensional mechanism Design: Reducing Revenue to Welfare Maximization." Joint with Yang Cai and Constantinos Daskalakis. |
| 2022 | **President's Award for Distinguished Teaching** ("The PADT awards honor a sustained record of distinguished teaching over the course of a career at Princeton, at both undergraduate and graduate levels. Normally two senior and two junior awards are given annually." Awarded at Princeton's Class of 2022 Commencement.) |
| 2022 | **Princeton Engineering Council Lifetime Achievement Award** (awarded to faculty who have received five Engineering Council Teaching Awards). |
| 2017, 2018, 2019, 2020, 2022 | **Princeton Engineering Council Teaching Award** (awarded to ≈ 4 Engineering faculty annually, selected by students), for COS 445. |
| 2018, 2019, 2021 | **Princeton Engineering Commendation List for Distinguished Teaching**, for COS 445 (2018) and COS 521 (2019, 2021) |
| 2020 | **Sloan Foundation Fellowship.** $75,000. |
| 2020 | **Google Faculty Research Award.** $80,000. Joint with Mark Braverman at Princeton (the award of $80,000 jointly supports Mark and myself). |
| 2020 - 2024 | **NSF-1955205. Collaborative Research:AF:Medium: Moderm Combinatorial Optimization: Incentives, Uncertainty, and Smoothed Analysis.** $415,957. REU Supplement $16,000. Joint with Aviad Rubinstein at Stanford (the award of $415,957 and $16,000 REU supplement support my research at Princeton — Aviad separately received additional funding through this award). |
| 2020 - 2024 | **NSF-1942497. CAREER: Towards a Prescriptive Theory of Algorithmic Mechanism Design** $602,818. |
| 2019 | **Phi Beta Kappa Teaching Award** (awarded annually to two Princeton professors, selected by students of Phi Beta Kappa honor society) |
| 2019 | **Howard B. Wentz Jr. Faculty Advancement Award**, from Princeton SEAS ("The award recognizes promising junior faculty members"). $50,000. |
| 2018 | **ACM Conference on Economics and Computation (EC) Best Full Paper Award** and **Best Paper with Student Lead Author Award**. For "Selling to a No-Regret Buyer." Joint with Mark Braverman, Jieming Mao, and Jon Schneider. |

| | |
|---|---|
| 2017-2020 | **NSF-1717899. AF: Small: Duality-based tools for simple vs. optimal mechanism design and applications to cryptocurrency**.  $450,000.  REU Supplement  $16,000. |
| 2014 | **SIGecom Doctoral Dissertation Award** |
| 2014 | **George M. Sprowls Award** (for best MIT doctoral theses in CS) |
| 2013 | **Microsoft Research PhD Fellow** |
| 2012 | **ACM Conference on Electronic Commerce (EC) Best Paper with Student Lead Author Award**. For "Symmetries and Optimal Multi-Dimensional Mechanism Design." Joint with Constantinos Daskalakis. |
| 2011 | **National Science Foundation Graduate Research Fellow** |
| 2010 | **Akamai Presidential Fellow** |
| 2010 | **National Physical Sciences Consortium Fellow** |

GRADUATE
ADVISING
EXPERIENCE

Ariel Schvartzman (PhD 2020). Postdoc at Rutgers 2020-2022. Researcher at Google 2022 - present.

Divyarthi Mohan (PhD 2021). Postdoc at Tel Aviv University 2021 - present.

Matheus Venturyne Xavier Ferreira (PhD 2021). Postdoc at Harvard 2021 - 2023. Faculty at University of Virginia CS starting Fall 2024.

Meryem Essaidi (PhD 2022). Postdoc at UC Berkeley 2022 - present.

Clayton Thomas (PhD 2023). Postdoc at Microsoft Research 2023 - present.

Linda Cai (MSE 2020, 4th year PhD).

Qianfan Zhang (2nd year PhD).

Jingyi Liu (2nd year PhD, co-advised with Mark Braverman).

Eric Xue (2nd year PhD, co-advised with Mark Braverman).

Stephen Newman (2nd year PhD, co-advised with Mark Braverman).

Kaya Ito Alpturer (1st year PhD).

Aadityan Ganesh (1st year PhD).

Chenghan Zhou (2nd year MSE).

Hedyeh Beyhaghi (visiting PhD student from 9/2017 - 9/2019). Postdoc at Northwestern and TTI 2019 - 2021. Postdoc at CMU 2021 - present.

Sahil Singla (postdoc 2018 - 2021). Assistant Professor at Georgia Tech Computer Science 2021 - present.

| | |
|---|---|
| UNDERGRADUATE ADVISING EXPERIENCE | I supervised 127 advisee-semesters (90 COS, 31 MAT, 2 ORF, 1 ECE, 3 PACM) over 11 semesters from Spring 2017 - Spring 2024. Below are year-by-year details. |
| 2023-2024 | I supervised the following five (5 COS) two-semester theses: Ty Kay (COS), Nicole Klausner (COS), Ryan McDowell (COS), Jude Muriithi (COS), Dwaipayan Saha (COS), the following one (COS) two-semester project: Arya Maheshwari (COS), and the following one (ECE) one-semester independent work: Amanda Wang (ECE). |
| 2022-2023 | I supervised the following six (5 COS, 1 MAT) two-semester theses: Aditya Gollapudi (COS), Richard Huang (COS), Frederick Qiu (COS), Dwaipayan Saha (COS), Anton Stengel (MAT), Henrique Vera (COS), the following one (MAT) one-semester independent work: Dimitar Chakarov (MAT), and the following one year-long project of a recent graduate: Sumanth Maddirala (MAT 2022), and the following one year-long project of a recent graduate of CMI: Aadityan Ganesh (MAT 2022). |
| 2021-2022 | I supervised the following eight (4 COS, 4 MAT) two-semester theses: Kiril Bangachev (MAT), Atanas Dinev (MAT), Nathan Finkle (COS), Anthony Hein (COS), Liam Johansson (MAT), Rahul Saha (COS), Catherine Yu (MAT), Jerry Zhu (COS), and the following four (3 COS, 1 MAT) one-semester independent works: Emily Dale (COS), Hannah Huh (COS), Austin Li (COS), Simon Park (MAT). |
| 2020-2021 | I supervised the following six (5 COS, 1 MAT) two-semester theses: Jessica Fielding (COS), Alice Gao (COS), Tinashe Handina (COS), Victor Hua (COS), Geoffrey Mon (COS), Seyoon Ragavan (MAT), the following six (3 COS, 3 MAT) one-semester independent works: Kiril Bangachev (MAT), Atanas Dinev (MAT), Ezra Edelman (COS), Michelle Woo (COS), Catherine Yu (MAT), Noa Zarur (COS), and the following PACM certificate projects: Emily Ryu (CHM). |
| 2019-2020 | I supervised the following seven (4 COS, 3 MAT) two-semester theses: Rebecca Barber (COS), Yafah Edelman (COS), William Jiao (MAT), Jonathan Jow (COS), Kevin Lin (MAT), Tristan Pollner (MAT), Shirley Zhang (COS), the following 4 (3 COS, 1 MAT) one-semester independent works: Jacob Christensen (MAT), Kimberly Ding (COS), Frankie Lam (COS), Kawin Tiyawattanaroj (COS), and the following PACM certificate projects: Sally Hahn (MAT), Seyoon Ragavan (MAT). |
| 2018-2019 | I supervised the following ten (10 COS) two-semester theses: Maryam Bahrani (COS), Rachana Balasubramanian (COS), Natalie Collina (COS), Jonathan Jow (COS), Pelumi Odimayo (COS), Simisola Olofinboba (COS), Jose Rodriguez Quinones (COS), Mel Shu (COS), Evan Wildenhain (COS), Albert Zuo (COS), the following two (2 COS) one-semester independent works: Moyin Opeyemi (COS), Eitan Zlatin (COS), and the following summer projects: Andrei Graur (MAT), Georgy Noarov (MAT), Tristan Pollner (MAT). |

| | |
|---|---|
| 2017-2018 | I supervised the following six (3 COS, 2 MAT, 1 ORF) two-semester theses: Maryam Bahrani (COS), Sung Won Chang (COS), Zach Halem (ORF), Heesu Hwang (MAT), Yash Patel (MAT), Bennett Victor (COS), the following eight (5 COS, 3 MAT) one-semester independent works: Richard Adjei (COS), Hrishikesh Khandeparkar (COS), Dylan Mavrides (MAT), Eric Neyman (MAT), Terri Rossi (COS) Evan Wildenhain (COS), Daphne Yang (MAT), Jonathan Zhang (COS), and the following visiting student: Jack Wang (Harvard, COS). |
| 2016-2017 | I supervised the following two-semester thesis: Will Rose (MAT). |

## PUBLICATIONS

| | |
|---|---|
| [RTWZ 24] | Shiri Ron, Clayton Thomas, S. Matthew Weinberg, Qianfan Zhang:<br>**Communication Separations for Truthful Auctions: Breaking the Two-Player Barrier**.<br>In the *65th Annual ACM Symposium on Theory of Computation (FOCS), 2024*. |
| [AW 24] | Kaya Alpturer, S. Matthew Weinberg:<br>**Optimal RANDAO Manipulation in Ethereum**.<br>In the *6th International Conference on Advances in Financial Technologies (AFT), 2024*. |
| | Linda Cai, Jingyi Liu, S. Matthew Weinberg, Chenghan ZhouCLWZ 24:<br>**Profitable Manipulations of Cryptographic Self-Selection are Statistically Detectable**.<br>In the *6th International Conference on Advances in Financial Technologies (AFT), 2024*. |
| [QW 24] | Frederick Qiu, S. Matthew Weinberg:<br>**Settling the Communication Complexity of VCG-based Mechanisms for All Approximation Guarantees**.<br>In the *56th Annual ACM Symposium on Theory of Computation (STOC), 2024*. |
| [BW 24] | Maryam Bahrani, S. Matthew Weinberg:<br>**Undetectable Selfish Mining**.<br>In the *25th Annual ACM Conference on Economics and Computation (EC), 2024*. |
| [DRWX 24] | Mahsa Derakhshan, Emily Ryu, S. Matthew Weinberg, Eric Xue:<br>**Settling the Competition Complexity of Additive Buyers of Independent Items**.<br>In the *25th Annual ACM Conference on Economics and Computation (EC), 2024*. |
| [BW 24] | Matheus V. X. Ferreira, Aadityan Ganesh, Jack Hourigan, Hannah HuhS. Matthew Weinberg, Catherine Yu:<br>**Computing Optimal Manipulations in Cryptographic Self-Selection** |

**Proof-of-Stake Protocols**.
In the *25th Annual ACM Conference on Economics and Computation (EC), 2024.*

[CTW 24]   Aadityan Ganesh, Clayton Thomas, S. Matthew Weinberg:
**Revisiting the Primitives of Transaction Fee Mechanism Design**.
In the *25th Annual ACM Conference on Economics and Computation (EC), 2024.*

[DW 24]   Atanas Dinev, S. Matthew Weinberg:
**Simple and Optimal Online Contention Resolution Schemes for $k$-Uniform Matroids**.
In the *15th Annual Innovations of Theoretical Computer Science (ITCS), 2024.*

[CWWZ 23]   Linda Cai, S. Matthew Weinberg, Evan Wildenhain, Shirley Zhang:
**Selling to Multiple No-Regret Buyers**.
In the *18th Conference on Web and Internet Economics (WINE), 2023.*

[CGW 23]   Linda Cai, Joshua Gardner, S. Matthew Weinberg, Shirley Zhang:
**Optimal Stopping with Multi-Dimensional Comparative Loss Aversion**.
In the *18th Conference on Web and Internet Economics (WINE), 2023.*

[SVW 23]   Raghuvansh R. Saxena, Santhoshini Velusamy, S. Matthew Weinberg:
**An Improved Lower Bound for Matroid Intersection Prophet Inequalities**.
In the *14th Annual Innovations of Theoretical Computer Science (ITCS), 2023.*

[DW 22]   Atanas Dinev, S. Matthew Weinberg:
**Tight Bounds on 3-Team Manipulations in Randomized Death Match**.
In the *18th Conference on Web and Internet Economics (WINE), 2022.*

[GRW 22]   Akash Gaonkar, Divya Raghunathan, S. Matthew Weinberg:
**The Derby Game: An Ordering-based Colonel Blotto Game**.
In the *23rd Annual ACM Conference on Economics and Computation (EC), 2022.*

[WZ 22]   S. Matthew Weinberg, Zixin Zhou:
**Optimal Multi-Dimensional Mechanisms are not Locally-Implementable**.
In the *23rd Annual ACM Conference on Economics and Computation (EC), 2022.*

[DFRSW 22]   Emily Dale, Jessica Fielding,, Hari Ramakrishnan, Sacheth Sathyanarayanan, S. Matthew Weinberg:
**Approximately Strategyproof Tournament Rules with Multiple Prizes**.
In the *23rd Annual ACM Conference on Economics and Computation (EC), 2022.*

[FHWY 22]   Matheus V.X. Ferreira, Ye Lin Sally Hahn, S. Matthew Weinberg, Catherine Yu:
**Optimal Strategic Mining against Cryptographic Self-Selection in Proof-of-Stake**.
In the *23rd Annual ACM Conference on Economics and Computation (EC), 2022*.

[PSW 22]   Christos-Alexandros Psomas, Ariel Schvartzman, S. Matthew Weinberg:
**On Infinite Separations Between Simple and Optimal Mechanisms**.
In the *35th Annual Conference and Workshop on Neural Information Processing Systems (NeurIPS), 2022*.

[CCFPW 22]   Jose Correa, Andres Cristi, Andres Fielbaum, Tristan Pollner, S. Matthew Weinberg:
**Optimal Item Pricing in Online Combinatorial Auctions**.
In the *23rd Annual Conference on Integer Programming and Combinatorial Optimization (IPCO), 2022*.

[EFW 22]   Meryem Essaidi, Matheus V. X. Ferreira, S. Matthew Weinberg:
**Credible, Strategyproof, Optimal, and Bounded Expected-Round Single-Item Auctions for All Distributions**.
In the *13th Annual Innovations of Theoretical Computer Science (ITCS), 2022*.

[EW 21]   Meryem Essaidi, S. Matthew Weinberg:
**On Symmetries in Multi-Dimensional Mechanism Design**.
In the *17th Conference on Web and Internet Economics (WINE), 2021*.
Accepted for oral presentation in the *1st Annual ACM Conference on Equity and Access in Algorithms, Mechanisms, and Optimization (EAAMO), 2021*.

[BBSW 21]   Maryam Bahrani, Hedyeh Beyhaghi, Sahil Singla, S. Matthew Weinberg:
**Formal Barriers to Simple Algorithms for the Matroid Secretary Problem**.
In the *17th Conference on Web and Internet Economics (WINE), 2021*.

[FW 21]   Matheus V. X. Ferreira, S. Matthew Weinberg:
**Proof of Stake Mining Games with Perfect Randomness**.
In the *22nd Annual ACM Conference on Economics and Computation (EC), 2021*.

[BSW 21]   Mark Braverman, Jon Schneider, S. Matthew Weinberg:
**Prior-free Dynamic Mechanism Design With Limited Liability**.
In the *22nd Annual ACM Conference on Economics and Computation (EC), 2021*.

[NNW 21]   Eric Neyman, Georgy Noarov S. Matthew Weinberg:
**Binary Scoring Rules that Incentivize Precision**.
In the *22nd Annual ACM Conference on Economics and Computation (EC), 2021*.

[RSTWZ 21]    Aviad Rubinstein, Raghuvansh R. Saxena, Clayton Thomas, S. Matthew Weinberg, Junyao Zhao:
**Exponential Communication Separations between Notions of Selfishness**.
In the *53rd Annual ACM Symposium on Theory of Computation (STOC), 2021*.

[RJW 21]    Jad Rahme, Sami Jelassi, S. Matthew Weinberg:
**Auction Learning as a Two-Player Game**.
In the *9th Annual International Conference on Learning Representations (ICLR), 2021*.

[RJBW 21]    Jad Rahme, Sami Jelassi, Joan Bruna, S. Matthew Weinberg:
**A Permutation Equivariant Neural Network Architecture for Auction Design**.
In the *35th Annual AAAI Conference on Artificial Intelligence (AAAI), 2021*.

[DW 21]    Kimberly Ding, S. Matthew Weinberg:
**Approximately Strategyproof Tournament Rules in the Probabilistic Setting**.
In the *12th Annual Innovations of Theoretical Computer Science (ITCS), 2021*.

[CKWLG 20]    Michael Chang, Sidhant Kaushik, S. Matthew Weinberg, Thomas L. Griffiths, Sergey Levine
**Decentralized Reinforcement Learning: Global Decision-Making via Local Economic Transactions**.
In the *37th Annual International Conference on Machine Learning (ICML), 2020*.

[BIMW 20]    Maryam Bahrani, Nicole Immorlica, Divyarthi Mohan, S. Matthew Weinberg:
**Asynchronous Majority Dynamics in Preferential Attachment Trees**.
In the *47th International Colloquium on Automata, Languages, and Programming (ICALP), 2020*.

[FW 20]    Matheus V. X. Ferreira, S. Matthew Weinberg:
**Credible, Truthful, and Two-Round (Optimal) Auctions via Cryptographic Commitments**.
In the *21st Annual ACM Conference on Economics and Computation (EC), 2020*.

[DGSSW 20]    Nikhil R. Devanur, Kira Goldner, Raghuvansh R. Saxena, Ariel Schvartzman, S. Matthew Weinberg:
**Optimal Mechanism Design for Single-Minded Agents**.
In the *21st Annual ACM Conference on Economics and Computation (EC), 2020*.

[CW 20]    Natalie Collina, S. Matthew Weinberg:
**On the (in)-approximability of Bayesian Revenue Maximization for**

|  | a Combinatorial Buyer.<br>In the *21st Annual ACM Conference on Economics and Computation (EC), 2020.* |
|---|---|
| [AKRW20, AKRW22] | Sepehr Assadi, Hrishikesh Khandeparkar, Raghuvansh R. Saxena, S. Matthew Weinberg:<br>**Separating the Communication Complexity of Truthful and Non-Truthful Combinatorial Auctions**.<br>In the *52nd Annual ACM Symposium on Theory of Computation (STOC), 2020.*<br>**Accepted to Special Issue of SIAM Journal on Computing (SICOMP)**. |
| [AKW 20] | Rediet Abebe, Jon Kleinberg, S. Matthew Weinberg:<br>**Subsidy Allocations in the Presence of Income Shocks**.<br>In the *34th Annual AAAI Conference on Artificial Intelligence (AAAI), 2020.* |
| [GPRW 20] | Andrei Graur, Tristan Pollner, Vidhya Ramaswamy, S. Matthew Weinberg:<br>**New Query Lower Bounds for Submodular Function Minimization**.<br>In the *11th Annual Innovations of Theoretical Computer Science (ITCS), 2020.* |
| [CTW 20] | Linda Cai, Clayton Thomas, S. Matthew Weinberg:<br>**Implementation in Advised Strategies: Welfare Guarantees from Posted-Price Mechanisms when Demand Queries are NP-hard**.<br>In the *11th Annual Innovations of Theoretical Computer Science (ITCS), 2020.* |
| [RWW 20] | Aviad Rubinstein, Jack Z. Wang, S. Matthew Weinberg:<br>**Optimal Single-Choice Prophet Inequalities from Samples**.<br>In the *11th Annual Innovations of Theoretical Computer Science (ITCS), 2020.* |
| [SWZZ 20] | Ariel Schvartzman, S. Matthew Weinberg, Eitan Zlatin, Albert Zuo:<br>**Approximately Strategyproof Tournament Rules: On Large Manipulating Sets and Cover-Consistence**.<br>In the *11th Annual Innovations of Theoretical Computer Science (ITCS), 2020.* |
| [EFNTW 19] | Tomer Ezra, Michal Feldman, Eric Neyman, Inbal Talgam-Cohen, S. Matthew Weinberg:<br>**Settling the Communication Complexity of Combinatorial Auctions with Two Subadditive Buyers**.<br>In the *60th Annual IEEE Symposium on Foundations of Computer Science (FOCS), 2019.* |
| [KMSSW 19] | Pravesh Kothari, Divyarthi Mohan, Ariel Schvartzman, Sahil Singla, S. Matthew Weinberg:<br>**Approximation Schemes for a Buyer with Independent Items via Symmetries**. |

In the *60th Annual IEEE Symposium on Foundations of Computer Science (FOCS), 2019.*

[PSW 19]    Christos-Alexandros Psomas, Ariel Schvartzman, S. Matthew Weinberg:
**Smoothed Analysis of Multi-Item Auctions with Correlated Values**.
In the *20th Annual ACM Conference on Economics and Computation (EC), 2019.*

[BNPW 19]    Jonah Brown-Cohen, Arvind Narayanan, Christos-Alexandros Psomas, S. Matthew Weinberg:
**Formal Barriers to Longest-Chain Proof-of-Stake Protocols**.
In the *20th Annual ACM Conference on Economics and Computation (EC), 2019.*

[BMSW 19]    Mark Braverman, Jieming Mao, Jon Schneider, S. Matthew Weinberg:
**Multi-Armed Bandit Problems with Strategic Arms**.
In the *32nd Annual Conference on Learning Theory (COLT), 2019.*

[BW 19]    Hedyeh Beyhaghi, S. Matthew Weinberg:
**Optimal (and Benchmark-Optimal) Competition Complexity for Additive Buyers over Independent Items**.
In the *51st Annual ACM Symposium on Theory of Computation (STOC), 2019.*

[FWHFC 19]    Matheus V. X. Ferreira, S. Matthew Weinberg, Danny Yuxing Huang, Nick Feamster, Tithi Chattopadhyay:
**Selling a Single Item with Negative Externalities: to Regulate Production or Payments?**.
In the *28th Annual World Wide Web Conference (WWW), 2019.*

[AW19, AW22]    Nick Arnosti, S. Matthew Weinberg:
**Bitcoin: A Natural Oligopoly**.
In the *10th Annual Innovations of Theoretical Computer Science (ITCS), 2019.*
**Accepted to Management Science**.

[DNPW 19]    Shaddin Dughmi, Rad Niazadeh, Christos-Alexandros Psomas, S. Matthew Weinberg:
**Persuasion and Incentives through the Lens of Duality**.
In the *15th Annual Conference on Web and Internet Economics (WINE), 2019.*

[GW18, GW21]    Yannai Gonczarowski, S. Matthew Weinberg:
**The Sample Complexity of up-to-$\varepsilon$ Multi-Dimensional Revenue Maximization**.
In the *59th Annual IEEE Symposium on Foundations of Computer Science (FOCS), 2018.*
**Accepted to Journal of the ACM (JACM)**.

[BMSW 18]    Mark Braverman and Jieming Mao and Jon Schneider and S. Matthew Weinberg:

**Selling to a No-Regret Buyer**.
In the *19th ACM Conference on Economics and Computation (EC), 2018*.
**Best Full Paper Award.**
**Best Paper with Student Lead Author Award.**

[KGCWF 18]  Harry Kalodner, Steven Goldfeder, Xiaoqi Chen, S. Matthew Weinberg, Edward W. Felten:
**Arbitrum: Scalable Smart Contracts**.
In the *27th Annual USENIX Security Symposium (USENIX), 2018*.

[RSW 18]  Aviad Rubinstein, Tselil Schramm, S. Matthew Weinberg:
**Computing exact minimum cuts without knowing the graph**.
In the *9th Annual Innovations of Theoretical Computer Science (ITCS), 2018*.

[BMW 18]  Mark Braverman, Jieming Mao, S. Matthew Weinberg:
**On Simultaneous Two-Player Combinatorial Auctions**.
In the *29th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2018*.

[SSW 18]  Raghuvansh R. Saxena, Ariel Schvartzman, S. Matthew Weinberg:
**The Menu Complexity of "one-and-a-half-dimensional" mechanism design**.
In the *29th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2018*.

[DW 17]  Nikhil R. Devanur, S. Matthew Weinberg:
**The Optimal Mechanism for Selling to a Budget Constrained Buyer: The General Case**.
In the *18th Annual ACM Conference on Economics and Computation (EC), 2017*.

[EFFTW17b, EFFTW21]  Alon Eden, Michal Feldman, Ophir Friedler, Inbal Talgam-Cohen, S. Matthew Weinberg:
**A Simple and Approximately Optimal Mechanism for a Buyer with Complements**.
In the *18th Annual ACM Conference on Economics and Computation (EC), 2017*.
**Accepted to Operations Research.**

[EFFTW 17a]  Alon Eden, Michal Feldman, Ophir Friedler, Inbal Talgam-Cohen, S. Matthew Weinberg:
**The Competition Complexity of Auctions: A Bulow-Klemperer Result for Multi-Dimensional Bidders**.
In the *18th Annual ACM Conference on Economics and Computation (EC), 2017*.

[HWZJC 17]  Zhe Huang, S. Matthew Weinberg, Liang Zheng, Carlee Joe-Wong, Mung Chiang:
**Discovering Valuations and Enforcing Truthfulness in a Deadline-Aware Scheduler**.

|  | In the *37th Annual IEEE Conference on Computer Communications (INFOCOM), 2017*. |
|---|---|
| [SSW 17] | Jon Schneider, Ariel Schvartzman, S. Matthew Weinberg:<br>**Condorcet-Consistent and Approximately Strategyproof Tournament Rules**.<br>In the *8th Innovations of Theoretical Computer Science Conference (ITCS), 2017*. |
| [CKWN 16] | Miles Carlsten, Harry Kalodner, S. Matthew Weinberg, Arvind Narayanan:<br>**On the Instability of Bitcoin without the Block Reward**.<br>In the *23rd Annual ACM Conference on Computer and Communications Security (CCS), 2016*. |
| [CDW16, CDW21] | Yang Cai, Nikhil Devanur, S. Matthew Weinberg:<br>**A Duality Based Unified Approach to Bayesian Mechanism Design**.<br>In the *48th Annual ACM Symposium on Theory of Computation (STOC), 2016*.<br>**Accepted to Special Issue of SIAM Journal on Computing (SICOMP)**. |
| [BMW 16b] | Mark Braverman, Jieming Mao, S. Matthew Weinberg:<br>**Parallel Algorithms for Select and Partition with Noisy Comparisons**.<br>In the *48th Annual ACM Symposium on Theory of Computation (STOC), 2016*. |
| [BMW 16a] | Mark Braverman, Jieming Mao, S. Matthew Weinberg:<br>**Interpolating Between Truthful and Non-truthful Mechanisms for Combinatorial Auctions**.<br>In the *27th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2016*. |
| [RW 15, RW 18] | Aviad Rubinstein, S. Matthew Weinberg:<br>**Simple Mechanisms for a Subadditive Buyer and Applications to Revenue Monotonicity**.<br>In the *16th Annual ACM Conference on Economics and Computation (EC), 2015*.<br>**Accepted to Special Issue of Transactions on Economics and Computation (TEAC)**. |
| [DDW15,DDW18] | Constantinos Daskalakis, Nikhil Devanur, S. Matthew Weinberg:<br>**Revenue Maximization and Ex-Post Budget Constraints**.<br>In the *16th Annual ACM Conference on Economics and Computation (EC), 2015*.<br>**Accepted to Special Issue of Transactions on Economics and Computation (TEAC)**. |
| [DMSW 15] | Nikhil Devanur, Jamie Morgenstern, Vasilis Syrgkanis, S. Matthew Weinberg:<br>**Simple Mechanisms with Simple Strategies**. |

In the *16th Annual ACM Conference on Economics and Computation (EC), 2015.*

[DW 15]  Constantinos Daskalakis, S. Matthew Weinberg:
**Bayesian Truthful Mechanisms for Job Scheduling from Bi-criterion Approximation Algorithms**.
In the *26th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2015.*

[DKTWW 15]  Constantinos Daskalakis, Nicolaas Kaashoek, Christos Tzamos, S. Matthew Weinberg, William Wu:
**Game Theory Based Peer Grading for MOOCs**.
In the *Second ACM Conference on Learning at Scale (L@S), 2015.*
Work in Progress paper.

[BILW14, BILW20]  Moshe Babaioff, Nicole Immorlica, Brendan Lucier, S. Matthew Weinberg:
**A Simple and Approximately Optimal Mechanism for an Additive Buyer**.
In the *55th Annual IEEE Symposium on Foundations of Computer Science (FOCS), 2014.*
**Accepted to Journal of the ACM (JACM)**.

[FILW 14]  Michal Feldman, Nicole Immorlica, Brendan Lucier, S. Matthew Weinberg:
**Reaching Consensus via non-Bayesian Asynchronous Learning in Social Networks**.
In the *17th International Workshop on Approximation Algorithms for Combinatorial Optimization Problems (APPROX), 2014.*

[AKW14, AKW19]  Pablo D. Azar, Robert Kleinberg, S. Matthew Weinberg:
**Prophet Inequalities with Limited Information**.
In the *25th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2014.*
**Accepted to Special Issue of Games and Economic Behavior (GEB)**.

[CDW 13b]  Yang Cai, Constantinos Daskalakis and S. Matthew Weinberg:
**Understanding Incentives: Mechanism Design Becomes Algorithm Design**.
In the *54th Annual IEEE Symposium on Foundations of Computer Science (FOCS), 2013.*

[CDW 13a]  Yang Cai, Constantinos Daskalakis and S. Matthew Weinberg:
**Reducing Revenue to Welfare Maximization: Approximation Algorithms and other Generalizations**.
In the *24th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2013.*

[ADMW 13]  Pablo Azar, Constantinos Daskalakis, Silvio Micali and S. Matthew Weinberg:
**Optimal and Efficient Parametric Auctions**.
In the *24th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2013.*

[CDW 12b]    Yang Cai, Constantinos Daskalakis and S. Matthew Weinberg:
**Optimal Multi-Dimensional Mechanism Design: Reducing Revenue to Welfare Maximization**.
In the *53rd Annual IEEE Symposium on Foundations of Computer Science (FOCS), 2012.*
**FOCS 2022 Test of Time Award.**

[DW 12]    Constantinos Daskalakis and S. Matthew Weinberg:
**Symmetries and Optimal Multi-Dimensional Mechanism Design**.
In the *13th ACM Conference on Electronic Commerce (EC), 2012.*
**Best Paper with Student Lead Author Award.**

[CDW 12a]    Yang Cai, Constantinos Daskalakis and S. Matthew Weinberg:
**An Algorithmic Characterization of Multi-Dimensional Mechanisms**.
In the *44th ACM Symposium on Theory of Computing (STOC), 2012.*

[KW 12, KW 19]    Robert Kleinberg and S. Matthew Weinberg:
**Matroid Prophet Inequalities**.
In the *44th ACM Symposium on Theory of Computing (STOC), 2012.*
**Accepted to Special Issue of Games and Economic Behavior (GEB)**.

[BCKW10,BCKW15]    Patrick Briest, Shuchi Chawla, Robert Kleinberg, and S. Matthew Weinberg:
**Pricing Randomized Allocations**.
In the *21st Annual ACM-SIAM Symposium on Discrete Algorithms (SODA), 2010.*
**Accepted to Special Issue of Journal of Economic Theory (JET)**.

ORGANIZED WORKSHOPS AND TUTORIALS

SIGecom Winter Meeting on Web3/Blockchain/Cryptocurrencies (with Scott Kominers), 2023.

Economics of Distributed Systems (with Jacob Leshno), Conference on Economics and Computation, 2022. Conference on Web and Internet Economics, 2022.

Algorithmic Game Theory Mentoring Workshop (with Michal Feldman and Raf Frongillo), Conference on Economics and Computation, 2020.

Early Career TCS Mentoring Workshop (with Yael Kalai and Aviad Rubinstein), Symposium on the Foundations of Computer Science, 2019.

Algorithmic Game Theory Mentoring Workshop (with Ariel Procaccia and Daniela Saban), Conference on Economics and Computation, 2019.

Tutorial on Incentives in Cryptocurrencies (with Jacob Leshno, Arvind Narayanan, Georgios Piliouras and Christos-Alexandros Psomas), Conference on Economics and Computation, 2018.

Algorithmic Game Theory Mentoring Workshop (with Nicole Immorlica and Ruta Mehta), Conference on Economics and Computation, 2018.

Workshop on Connections between Theory of Computation and Mechanism design (with Yang Cai and Shuchi Chawla), Symposium on Theory of Computing, 2017.

Tutorial on Prophet Inequalities and Secretary Problems, Simons Institute Bootcamp for Algorithms and Uncertainty, Berkeley, 2016.

Tutorial on Bayesian Mechanism Design (with Yang Cai and Constantinos Daskalakis), Conference on Economics and Computation, 2014.

PROFESSIONAL
SERVICE

ACM Transactions on Economics and Computation (TEAC): Associate Editor (2022 - present).

ACM SIGecom Exchanges: Co-Editor (2018-2022).

ACM Symposium on the Theory of Computing (STOC): Program Committee (2022, 2024).

ACM Conference on Economics and Computation (EC): Area Chair (2021, 2023), Senior Program Committee (2017, 2019, 2020, 2024), Treasurer (2016), Program Committee (2015, 2016, 2018, 2022). Distinguished Senior PC member (2019). Distinguished PC member (2018).

ACM-SIAM Symposium on Discrete Algorithms (SODA): Program Committee (2017, 2022)

Advances in Financial Technologies (AFT): Program Chair (2023), General Chair (2023), Program Committee (2019, 2020, 2021)

SIAM Journal on Computing (SICOMP): Associate Editor for STOC 2024 Special Issue (2024).

International Colloquium on Automata, Languages and Programming (ICALP): Program Committee (2017)

Innovations in Theoretical Computer Science (ITCS): Program Committee (2019, 2021, 2024)

ACM Conference on Equity and Access in Algorithms, Mechanisms, and Optimization (EAAMO): Area Chair (2021)

International World Wide Web Conference (WWW): Program Committee (2017), Outstanding Reviewer Award (2017)

Conference on Web and Internet Economics (WINE): Senior Program Committee (2022), Program Committee (2016, 2017, 2018, 2019, 2020)

Workshop on the Economics of Networks, Systems and Computation (NetEcon): Program Committee (2016, 2018)

Conference on Auctions, Market Mechanisms and Their Applications (AMMA): Program Committee (2015)

International Conference on Artificial Intelligence (IJCAI): Program Committee (2013)

IEEE International Workshop on Network Science for Communication Networks: Program Committee (2017)

Workshop on Mechanism Design for Social Good (MD4SG): Program Committee (2017, 2018, 2019, 2020)

Computing Research Association (CRA): Undergraduate Research Awards Committee Member (2022, 2023).

DEPARTMENTAL AND UNIVERSITY SERVICE

SEAS DeCenter. Associate Director (07/2023 - present), Steering Committee (06/2022 - present), Faculty Search Committee (2022-2023, 2023-2024).

Council of the Princeton University Community. Member (06/2023 - present), Executive Committee (06/2023 - present), Faculty Advisory Committee on Policy (06/2023 - present).

COS Committee on Diversity, Climate, and Inclusion, Member (09/2018 - present), Lead for issues related to grad admissions (01/2021 - 08/2022), Chair (09/2022 - present).

Center for Information and Technology Policy. Faculty Search Committee (2023-2024).

Council on Teaching and Learning, Member (09/2020 - 06/2023).

Faculty advisor for JuST (2020 - 2022).

Theory group lead for 2019-2020 and 2021-2022 (co-led with Huacheng Yu) graduate admissions.

Co-coordinated (with Adam Finkelstein) COS TA assignment for fall 2021 and spring 2022.

Mathey BSE Advisor (09/2017 - 06/2018). COS BSE Academic Advisor (90/2018 - 6/2021). Whitman AB Advisor (09/2021 - present).

Undergraduate advising: 101 advisee-semesters (68 COS, 28 MAT, 2 ORF, 3 PACM) from 01/2017 - 06/2022.

President's Award for Distinguished Teaching. Selection Committee (2023).

VISITING POSITIONS AND INTERNSHIPS
Summer 2022

**a16z Crypto**                                                              **New York, NY**
Summer Faculty Fellow.

| Fall 2016 | **Simons Institute for the Theory of Computing** | **Berkeley, CA** |
|---|---|---|

Research Fellow, Semester on Algorithms and Uncertainty.

| Fall 2015 | **Simons Institute for the Theory of Computing** | **Berkeley, CA** |
|---|---|---|

Research Fellow, Semester on Economics and Computation.

| Summer 2013 | **Microsoft Research - New England** | **Cambridge, MA** |
|---|---|---|

Research Intern with Nicole Immorlica and Brendan Lucier.

| Summer 2011 | **Department of Defense** | **Fort Meade, MD** |
|---|---|---|

NPSC Intern. References available upon request.

| Summer 2010 | **Institute for Defense Analyses** | **Princeton, NJ** |
|---|---|---|

SCAMP Participant. References available upon request.

| Summer 2009 | **Department of Defense** | **Fort Meade, MD** |
|---|---|---|

Director's Summer Program. References available upon request.

| Summer 2008 | **University of Maryland** | **College Park, MD** |
|---|---|---|

REU in network security with Professor Michel Cukier.

**Appendix B: Materials Relied Upon & Materials Considered**

## MATERIALS RELIED UPON

1. GOOG-NE-05308018
2. GOOG-DOJ-14141075
3. GOOG-DOJ-28486313
4. GOOG-DOJ-14380896
5. GOOG-DOJ-29803801
6. GOOG-AT-MDL-B-006338037
7. GOOG-AT-MDL-013107815
8. GOOG-TEX-00156142
9. GOOG-14368357
10. GOOG-TEX-00858434
11. GOOG-DOJ-15426070
12. GOOG-AT-MDL-004416785
13. GOOG-NE-06835928
14. GOOG-DOJ-14716953
15. GOOG-DOJ-14716780
16. GOOG-AT-MDL-017393789
17. GOOG-AT-MDL-001004706
18. GOOG-AT-MDL-B-004124703
19. GOOG-NE-04934281
20. GOOG-NE-06151351
21. GOOG-AT-MDL-010338120
22. GOOG-DOJ-AT-02323144
23. GOOG-AT-MDL-012331940
24. GOOG-AT-MDL-001391101
25. GOOG-AT-MDL-B-003716246
26. GOOG-DOJ-15588979
27. GOOG-AT-MDL-B-005180778
28. GOOG-NE-13379438
29. GOOG-DOJ-14365517
30. GOOG-DOJ-14421383
31. GOOG-DOJ-14030931
32. GOOG-NE-06828586
33. GOOG-DOJ-AT-02368104
34. GOOG-DOJ-14140113
35. GOOG-AT-MDL-004229707
36. GOOG-AT-MDL-003161451
37. DISNEY_TR_00000001
38. GOOG-DOJ-14549757
39. GOOG-DOJ-11406673
40. GOOG-DOJ-09713317
41. AMZNDOJ0159229
42. AMZNDOJ0023642
43. GOOG-AT-MDL-008842393
44. GOOG-DOJ-AT-00576443
45. GOOG-AT-MDL-B-008151156
46. GOOG-DOJ-AT-02424328
47. MSFT-LIT-0000072452
48. GOOGTEX- 00831090
49. GOOG-AT-MDL-B-002108440
50. GOOG-DOJ-14380727
51. GOOG-DOJ-14271577
52. GOOG-DOJ-AT-00569648
53. GOOG-DOJ-12948968
54. GOOG-DOJ-AT-00173317
55. GOOG-DOJ-AT -00175537
56. GOOG-DOJ-13605152
57. GOOG-NE-11753797
58. FBDOJ012957554
59. CRITEO_GOOGLELIT_0000011698
60. GOOG-NE-13207241
61. GOOG-NE-13234466
62. GOOG-AT-MDL-001873044
63. GOOG-AT-MDL-002316501
64. GOOG-TEX-00831373
65. GOOG-017664768
66. GOOG-DOJ-13235100
67. GOOG-AT-MDL-015283483
68. GOOG-AT-MDL-C-000035251
69. GOOG-AT-MDL-C-000035252
70. GOOG-AT-MDL-C-000015606
71. GOOG-AT-MDL-B-008550566
72. GOOG-AT-MDL-B-007768543
73. GOOG-AT-MDL-011234683
74. GOOG-TEX-00325057
75. GOOG-TEX-00325061
76. GOOG-NE-13371217
77. GENTRY_TR_00000001
78. SOVRN+000106
79. GOOG-DOJ-13212948
80. GOOG-DOJ-15426837
81. GOOG-TEX-00831373
82. GOOG-AT-MDL-B-006365895

1

## **MATERIALS CONSIDERED**

### Pleadings

The live pleadings (complaint and answer) within the matter of *The State of Texas, et al. v. Google*, Case Number: 4:20-cv-00957-SDJ, including the Fourth Amended Complaint.

### Discovery Responses

All available discovery responses produced within the matter of *The State of Texas, et al. v. Google*, Case Number: 4:20-cv-00957-SDJ, including:

1. The Parties' amended initial disclosures;
2. The Parties' discovery responses and objections to Interrogatories, Requests for Admission, and Requests for Production; and
3. Google's written responses to Plaintiffs' Rule 30(b)(6) Notice.

### Deposition Transcripts & Exhibits

All available deposition transcripts and exhibits within the matter of *The State of Texas, et al. v. Google*, Case Number: 4:20-cv-00957-SDJ, including:

1. Deposition and Exhibits of
2. Deposition and Exhibits of
3. Deposition and Exhibits of
4. Deposition and Exhibits of
5. Deposition and Exhibits of
6. Deposition and Exhibits of
7. Deposition and Exhibits of
8. Deposition and Exhibits of
9. Deposition and Exhibits of
10. Deposition and Exhibits of
11. Deposition and Exhibits of
12. Deposition and Exhibits of
13. Deposition and Exhibits of
14. Deposition and Exhibits of
15. Deposition and Exhibits of
16. Deposition and Exhibits of
17. Deposition and Exhibits of
18. Deposition and Exhibits of
19. Deposition and Exhibits of
20. Deposition and Exhibits of
21. Deposition and Exhibits of
22. Deposition and Exhibits of

23. Deposition and Exhibits of
24. Deposition and Exhibits of
25. Deposition and Exhibits of
26. Deposition and Exhibits of
27. Deposition and Exhibits of
28. Deposition and Exhibits of
29. Deposition and Exhibits of
30. Deposition and Exhibits of
31. Deposition and Exhibits of
32. Deposition and Exhibits of
33. Deposition and Exhibits of
34. Deposition and Exhibits of
35. Deposition and Exhibits of
36. Deposition and Exhibits of
37. Deposition and Exhibits of
38. Deposition and Exhibits of
39. Deposition and Exhibits of                                                    4
40. Deposition and Exhibits of
41. Deposition and Exhibits of
42. Deposition and Exhibits of
43. Deposition and Exhibits of
44. Deposition and Exhibits of
45. Deposition and Exhibits of                                                    3,
    2024
46. Deposition and Exhibits of
47. Deposition and Exhibits of
48. Deposition and Exhibits of
49. Deposition and Exhibits of
50. Deposition and Exhibits of
51. Deposition and Exhibits of
52. Deposition and Exhibits of
53. Deposition and Exhibits of
54. Deposition and Exhibits of
55. Deposition and Exhibits of
56. Deposition and Exhibits of
57. Deposition and Exhibits of
58. Deposition and Exhibits of
59. Deposition and Exhibits of
60. Deposition and Exhibits of
61. Deposition and Exhibits of
62. Deposition and Exhibits of
63. Deposition and Exhibits of
64. Deposition and Exhibits of

65. Deposition and Exhibits of
66. Deposition and Exhibits of
67. Deposition and Exhibits of
68. Deposition and Exhibits of
69. Deposition and Exhibits of
70. Deposition and Exhibits of
71. Deposition and Exhibits of
72. Deposition and Exhibits of
73. Deposition and Exhibits of
74. Deposition and Exhibits of
    Kratkiewicz), May 1, 2024
75. Deposition and Exhibits of
    Puckett), May 1, 2024
76. Deposition and Exhibits of
    Kuchta), May 3, 2024
77. Deposition and Exhibits of
78. Deposition and Exhibits of
    2024
79. Deposition and Exhibits of
80. Deposition and Exhibits of
81. Deposition and Exhibits of
82. Deposition and Exhibits of
    Smaragdis), April 29, 2024
83. Deposition and Exhibits of
84. Deposition and Exhibits of

All available deposition transcripts and exhibits within the matter of *USA v. Google*, Case
Number: 1:23-cv-00108-LMB-JFA, including:

85.  Deposition and Exhibits of
86.  Deposition and Exhibits of
87.  Deposition and Exhibits of
88.  Deposition and Exhibits of
89.  Deposition and Exhibits of
90.  Deposition and Exhibits of
91.  Deposition and Exhibits of
92.  Deposition and Exhibits of
93.  Deposition and Exhibits of
94.  Deposition and Exhibits of
95.  Deposition and Exhibits of
96.  Deposition and Exhibits of
97.  Deposition and Exhibits of

98.   Deposition and Exhibits of
99.   Deposition and Exhibits of
100.  Deposition and Exhibits of
101.  Deposition and Exhibits of
102.  Deposition and Exhibits of
103.  Deposition and Exhibits of
104.  Deposition and Exhibits of
105.  Deposition and Exhibits of
106.  Deposition and Exhibits of
107.  Deposition and Exhibits of
108.  Deposition and Exhibits of
109.  Deposition and Exhibits of
110.  Deposition and Exhibits of
111.  Deposition and Exhibits of
112.  Deposition and Exhibits of
113.  Deposition and Exhibits of
114.  Deposition and Exhibits of
115.  Deposition and Exhibits of
116.  Deposition and Exhibits of
117.  Deposition and Exhibits of
118.  Deposition and Exhibits of
119.  Deposition and Exhibits of
120.  Deposition and Exhibits of
121.  Deposition and Exhibits of
122.  Deposition and Exhibits of
123.  Deposition and Exhibits of
124.  Deposition and Exhibits of
125.  Deposition and Exhibits of
126.  Deposition and Exhibits of
127.  Deposition and Exhibits of
128.  Deposition and Exhibits of
129.  Deposition and Exhibits of
130.  Deposition and Exhibits of
131.  Deposition and Exhibits of
132.  Deposition and Exhibits of
133.  Deposition and Exhibits of
134.  Deposition and Exhibits of
135.  Deposition and Exhibits of
136.  Deposition and Exhibits of
137.  Deposition and Exhibits of
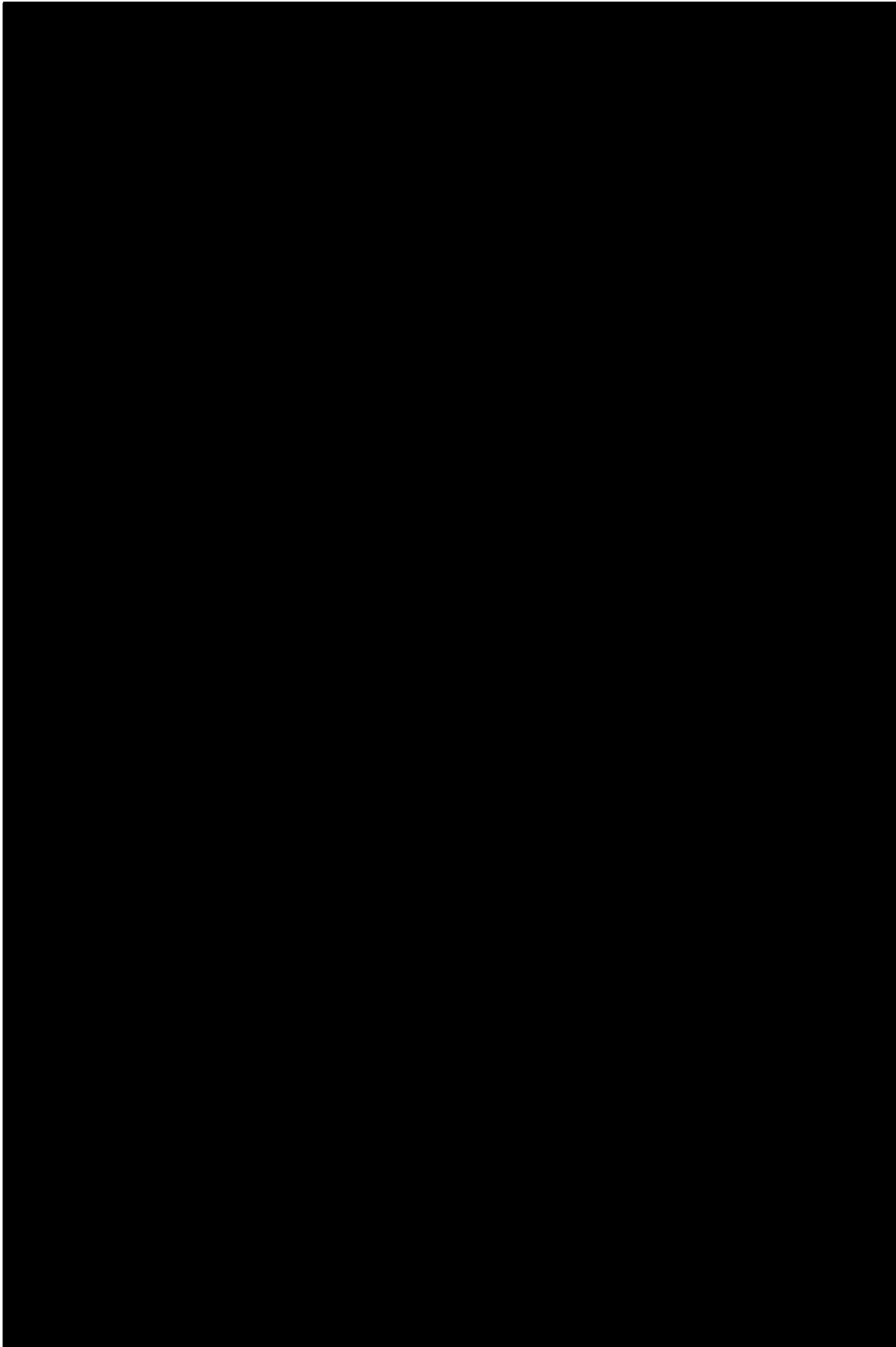138.  Deposition and Exhibits of

All available deposition transcripts and exhibits within the matter of *In re: Google Digital Advertising Antitrust Litigation*, Case Number: 1:21-md-03010-PKC, including the depositions and exhibits of:

Other available deposition transcripts and exhibits, including the depositions and exhibits of:
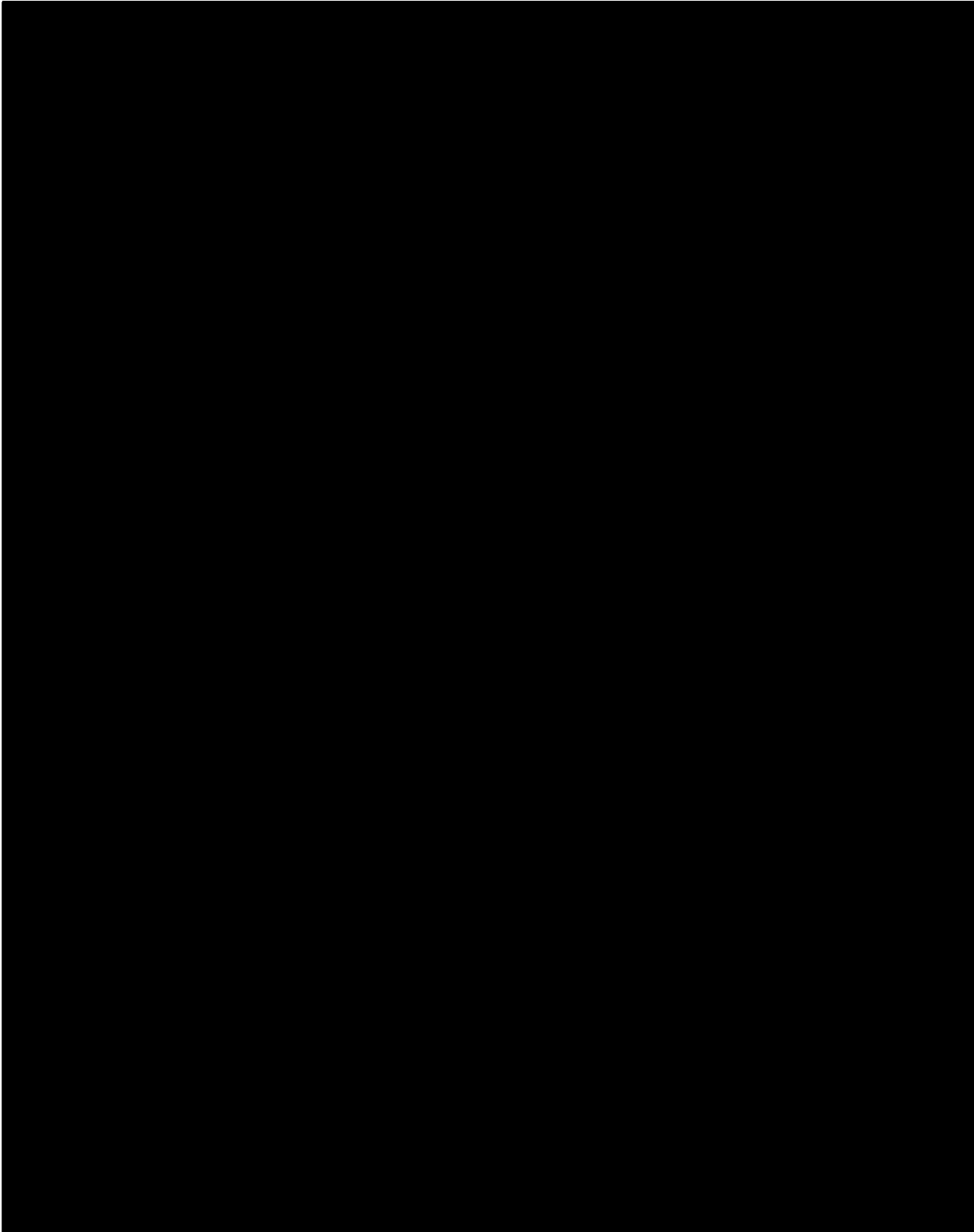
Expert Reports & Declarations

All available expert reports, including appendices, backup materials, and cited materials, within
the matter of *The State of Texas, et al. v. Google*, Case Number: 4:20-cv-00957-SDJ, including:

1. 2024.06.07 Expert Report of Jeffrey S. Andrien
2. 2024.06.07 Expert Report of Joshua Gans, as well as 2024.07.24 Errata and
   Supplemental Appendix D
3. 2024.06.07 Expert Report of Jacob Hostetler
4. 2024.06.07 Expert Report of John Chandler
5. 2024.06.07 Expert Report of Matthew Weinberg
6. 2024.06.07 Expert Report of Parag Pathak

7. 2024.07.30 Expert Report of Anindya Ghose
8. 2024.07.30 Expert Report of Donna L. Hoffman
9. 2024.07.30 Expert Report of Douglas Skinner
10. 2024.07.30 Expert Report of Itamar Simonson
11. 2024.07.30 Expert Report of Martin C. Rinard
12. 2024.07.30 Expert Report of Paul R. Milgrom
13. 2024.07.30 Expert Report of Steven N. Wiggins
14. 2024.08.06 Expert Report of Michael R. Baye
15. 2024.08.06 Expert Report of Jason Nieh

All available expert reports (with redactions) within the matter of *USA v. Google*, Case Number:
1:23-cv-00108-LMB-JFA, including:

1. Declarations of Google Employees
2. 2023.12.22 Expert Report of Gabriel Weintraub, GOOG-AT-MDL-C-000018734
3. 2023.12.22 Expert Report of R. Ravi, GOOG-AT-MDL-C-000019017
4. 2023.12.22 Expert Report of Robin S. Lee, GOOG-AT-MDL-C-000019273
5. 2023.12.22 Expert Report of Rosa Abrantes-Metz, GOOG-AT-MDL-C-000019786
6. 2023.12.22 Expert Report of Thomas S. Respess, GOOG-AT-MDL-C-000020106
7. 2023.12.22 Expert Report of Timothy Simcoe, GOOG-AT-MDL-C-000020274
8. 2024.01.13 Errata to Abrantes-Metz Expert Report, GOOG-AT-MDL-C-000020435
9. 2024.01.13 Errata to Ravi Expert Report, GOOG-AT-MDL-C-000020437
10. 2024.01.13 Errata to Respess Expert Report, GOOG-AT-MDL-C-000020440
11. 2024.01.13 Errata to Simcoe Expert Report, GOOG-AT-MDL-C-000020467
12. 2024.01.13 Errata to Weintraub Expert Report, GOOG-AT-MDL-C-000020471
13. 2024.01.23 Chevalier Expert Report, GOOG-AT-MDL-C-000020474
14. 2024.01.23 Ferrante Expert Report, GOOG-AT-MDL-C-000020714

15. 2024.01.23 Ghose Expert Report, GOOG-AT-MDL-C-000020767

16. 2024.01.23 Israel Expert Report, GOOG-AT-MDL-C-000021036

17. 2024.01.23 Milgrom Expert Report, GOOG-AT-MDL-C-000021794

18. 2024.01.23 Rinard Expert Report, GOOG-AT-MDL-C-000022191

19. 2024.01.23 Shirky Expert Report, GOOG-AT-MDL-C-000022229

20. 2024.01.23 Simonson Expert Report, GOOG-AT-MDL-C-000022290

21. 2024.01.23 Skinner Expert Report, GOOG-AT-MDL-C-000022948

22. 2024.02.13 Expert Rebuttal Report of Adoria Lim, GOOG-AT-MDL-C-000023002

23. 2024.02.13 Expert Rebuttal Report of Gabriel Weintraub, GOOG-AT-MDL-C-000023226

24. 2024.02.13 Expert Rebuttal Report of Kenneth Wilbur, GOOG-AT-MDL-C-000023322

25. 2024.02.13 Expert Rebuttal Report of R. Ravi, GOOG-AT-MDL-C-000023435

26. 2024.02.13 Expert Rebuttal Report of Robin S. Lee, GOOG-AT-MDL-C-000023516

27. 2024.02.13 Expert Rebuttal Report of Rosa Abrantes-Metz, GOOG-AT-MDL-C-000023887

28. 2024.02.13 Expert Rebuttal Report of Timothy Simcoe, GOOG-AT-MDL-C-000024064

29. 2024.02.13 Expert Rebuttal Report of Wayne Hoyer, GOOG-AT-MDL-C-000024138

30. 2024.02.13 Expert Rebuttal Report of Wenke Lee, GOOG-AT-MDL-C-000024270

31. 2024.02.16 Errata to Ravi Rebuttal Report, GOOG-AT-MDL-C-000024387

32. 2024.02.20 Errata to Simcoe Rebuttal Report, GOOG-AT-MDL-C-000024389

33. 2024.02.23 Errata to Weintraub Rebuttal Report, GOOG-AT-MDL-C-000024390

34. 2024.02.23 Supplemental Errata to Weintraub Expert Report, GOOG-AT-MDL-C-000024391

35. 2024.02.24 Errata to Wilbur Rebuttal Report, GOOG-AT-MDL-C-000024392

36. 2024.02.26 Errata to Hoyer Rebuttal Report, GOOG-AT-MDL-C-000024397

37. 2024.02.28 Errata to Abrantes-Metz Rebuttal Report, GOOG-AT-MDL-C-000024399

38. 2024.03.04 Expert Supplemental Report of Robin S. Lee, GOOG-AT-MDL-C-000024403

39. 2024.03.08 Consolidated Errata to Lee Rebuttal Report, GOOG-AT-MDL-C-000024436

40. 2024.01.13 Expert Report of Weintraub Errata, GOOG-AT-MDL-C-000040965

41. 2024.01.13 Expert Report of Simcoe Errata, GOOG-AT-MDL-C-000040961

42. 2024.01.13 Expert Report of Respess Errata_with Figure Errata_Redacted, GOOG-AT-MDL-C-000040934

43. 2024.01.13 Expert Report of R Ravi Errata, GOOG-AT-MDL-C-000040931

44. 2024.01.13 Expert Report of Abrantes-Metz Errata, GOOG-AT-MDL-C-000040929

45. 2024.03.08 Consolidated Errata to Lee Rebuttal Report, GOOG-AT-MDL-C-000040926

46. 2024.03.04 Expert Supplemental Report of Robin S. Lee, PhD, GOOG-AT-MDL-C-000040893

47. 2024.02.28 Rebuttal Report Errata of Rosa Abrantes-Metz Signed, GOOG-AT-MDL-C-000040889

48. 2024.02.25 Expert Rebuttal Report of Hoyer Errata, GOOG-AT-MDL-C-000040887

49. 2024.02.24 Wilbur Rebuttal Errata, GOOG-AT-MDL-C-000040882

50. 2024.02.23 Weintraub Rebuttal Report Errata, GOOG-AT-MDL-C-000040881

51. 2024.02.23 Expert Report of Weintraub Supplemental Errata, GOOG-AT-MDL-C-000040880

52. 2024.02.20 Errata to Simcoe Rebuttal Report, GOOG-AT-MDL-C-000040879

53. 2024.02.16 Errata to Ravi Rebuttal Report (Highly Confidential), GOOG-AT-MDL-C-000040877

54. 2024.02.13 Rebuttal Report of Rosa Abrantes-Metz, GOOG-AT-MDL-C-000040700

55. 2024.02.13 Expert Report of Wenke Lee, GOOG-AT-MDL-C-000040583

56. 2024.02.13 Expert Rebuttal Report of Wayne Hoyer, GOOG-AT-MDL-C-000040451

57. 2024.02.13 Expert Rebuttal Report of Timothy Simcoe_Redacted, GOOG-AT-MDL-C-000040377

58. 2024.02.13 Expert Rebuttal Report of Robin S. Lee_Redacted, GOOG-AT-MDL-C-000040006

59. 2024.02.13 Expert Rebuttal Report of R Ravi, GOOG-AT-MDL-C-000039925

60. 2024.02.13 Expert Rebuttal Report of Kenneth Wilbur_Redacted, GOOG-AT-MDL-C-000039812

61. 2024.02.13 Expert Rebuttal Report of Gabriel Weintraub_Redacted, GOOG-AT-MDL-C-000039716

62. 2024.02.13 Expert Rebuttal Report of Adoria Lim_Redacted, GOOG-AT-MDL-C-000039492

63. 2024.01.23 Expert Report of William Clay Shirky, GOOG-AT-MDL-C-000039431

64. 2024.01.23 Expert Report of Paul R. Milgrom, GOOG-AT-MDL-C-000039034

65. 2024.01.23 Expert Report of Martin C. Rinard, GOOG-AT-MDL-C-000038996

66. 2024.01.23 Expert Report of Mark A. Israel_Redacted, GOOG-AT-MDL-C-000038238

67. 2024.01.23 Expert Report of Judith A. Chevalier_Redacted, GOOG-AT-MDL-C-000037998

68. 2024.01.23 Expert Report of Itamar Simonson, GOOG-AT-MDL-C-000037340

69. 2024.01.23 Expert Report of Douglas Skinner, GOOG-AT-MDL-C-000037286

70. 2024.01.23 Expert Report of Anthony J. Ferrante, GOOG-AT-MDL-C-000037233

71. 2024.01.23 Expert Report of Anindya Ghose_Redacted, GOOG-AT-MDL-C-000036954

72. 2023.12.22 Expert Report of Timothy Simcoe_Redacted, GOOG-AT-MDL-C-000036793

73. 2023.12.22 Expert Report of Thomas Respess_Redacted, GOOG-AT-MDL-C-000036625

74. 2023.12.22 Expert Report of Rosa Abrantes-Metz_Redacted, GOOG-AT-MDL-C-000036305

75. 2023.12.22 Expert Report of Robin S. Lee, PhD_Redacted, GOOG-AT-MDL-C-000035792

76. 2023.12.22 Expert Report of R Ravi_Redacted, GOOG-AT-MDL-C-000035536

77. 2023.12.22 Expert Report of Gabriel Weintraub_Redacted, GOOG-AT-MDL-C-000035253

Bates Stamped Productions, including access to Plaintiffs' entire production database, as well as
the following documents and Google and third-party productions made since June 7, 2024:

| | | | |
|---|---|---|---|
| 1. | DM_GOOG_0027446 | 40. | GOOG-AT-MDL-001263607 |
| 2. | FBDOJ012641326 /<br>MetaTx_000000680 | 41. | GOOG-AT-MDL-001390730 |
| | | 42. | GOOG-AT-MDL-001391213 |
| 3. | FBDOJGOOG_00478712 | 43. | GOOG-AT-MDL-001933227 |
| 4. | FBDOJGOOG_00986815 | 44. | GOOG-AT-MDL-002105969 |
| 5. | FBDOJGOOG_01484801 | 45. | GOOG-AT-MDL-002105984 |
| 6. | FBTEX_00078430 | 46. | GOOG-AT-MDL-002124829 |
| 7. | FBTEX_00079937 | 47. | GOOG-AT-MDL-002390899 |
| 8. | FBTEX_00116640 /<br>FBTEX_00116632 | 48. | GOOG-AT-MDL-002393442 |
| | | 49. | GOOG-AT-MDL-003161451 |
| 9. | FBTEX_00277880 | 50. | GOOG-AT-MDL-004074544 |
| 10. | FBDOJGOOG_00327692 | 51. | GOOG-AT-MDL-004232880 |
| 11. | FBTEX_00327637 /<br>FBTEX_00327634 | 52. | GOOG-AT-MDL-004233138 |
| | | 53. | GOOG-AT-MDL-004300268 |
| 12. | FBTEX_00327690 | 54. | GOOG-AT-MDL-004416785 |
| 13. | FBTEX_00334404 | 55. | GOOG-AT-MDL-004436768 |
| 14. | FBTEX_00482531 | 56. | GOOG-AT-MDL-004555181 |
| 15. | FBTEX_00528526 | 57. | GOOG-AT-MDL-006099844 |
| 16. | FBTEX_00540345 | 58. | GOOG-AT-MDL-006161050 |
| 17. | FBTEX_00585545 /<br>FBTEX_00585544 | 59. | GOOG-AT-MDL-006334729 |
| | | 60. | GOOG-AT-MDL-006873424 |
| 18. | FBTEX_00797666 | 61. | GOOG-AT-MDL-006966530 |
| 19. | FBTEX_00808277 | 62. | GOOG-AT-MDL-007175167 |
| 20. | FBTEX_00813671 | 63. | GOOG-AT-MDL-007343585 |
| 21. | FBTEX_00837148 | 64. | GOOG-AT-MDL-007346556 |
| 22. | FBTEX_00854833 | 65. | GOOG-AT-MDL-007364833 |
| 23. | FBTEX_00892345 | 66. | GOOG-AT-MDL-007375672 |
| 24. | FBTEX_00969349 | 67. | GOOG-AT-MDL-007387750 |
| 25. | FBTEX_01003026 | 68. | GOOG-AT-MDL-007397182 |
| 26. | FBTEX_01021169 | 69. | GOOG-AT-MDL-007397197 |
| 27. | FBTEX_01062704 | 70. | GOOG-AT-MDL-008148533 /<br>GOOG-AT-MDL-008148529 |
| 28. | FBTEX_01064247 | | |
| 29. | FBTEX_01064318 | 71. | GOOG-AT-MDL-008517788 |
| 30. | FBTEX_01080688 | 72. | GOOG-AT-MDL-008588684 |
| 31. | FBTEX_01082050 | 73. | GOOG-AT-MDL-008682082 /<br>GOOG-AT-MDL-008682071 |
| 32. | FBTEX_01089475 | | |
| 33. | FBTEX_01103919 | 74. | GOOG-AT-MDL-008754374 |
| 34. | FBTEX_01131531 | 75. | GOOG-AT-MDL-008835346 |
| 35. | FBTEX_01200160 | 76. | GOOG-AT-MDL-008858602 |
| 36. | FBTEX_01254367 | 77. | GOOG-AT-MDL-008881206 |
| 37. | FBTEX_01274568 | 78. | GOOG-AT-MDL-008886980 |
| 38. | FBTEX_00528334 | 79. | GOOG-AT-MDL-008953893 |
| 39. | FTC_US-GOOGLE-000004531 | 80. | GOOG-AT-MDL-008964888 |

| | | | | |
|---|---|---|---|---|
| 81. | GOOG-AT-MDL-008979664 | | 127. | GOOG-AT-MDL-017187837 |
| 82. | GOOG-AT-MDL-008991390 | | 128. | GOOG-AT-MDL-017394050 |
| 83. | GOOG-AT-MDL-009026140 | | 129. | GOOG-AT-MDL-017494582 |
| 84. | GOOG-AT-MDL-009289718 | | 130. | GOOG-AT-MDL-017664768 |
| 85. | GOOG-AT-MDL-009291120 | | 131. | GOOG-AT-MDL-017746412 |
| 86. | GOOG-AT-MDL-009299907 | | 132. | GOOG-AT-MDL-017749638 |
| 87. | GOOG-AT-MDL-009321580 | | 133. | GOOG-AT-MDL-017762649 |
| 88. | GOOG-AT-MDL-009429957 | | 134. | GOOG-AT-MDL-017864022 |
| 89. | GOOG-AT-MDL-012512067 | | 135. | GOOG-AT-MDL-018248228 |
| 90. | GOOG-AT-MDL-012514705 | | 136. | GOOG-AT-MDL-018427318 |
| 91. | GOOG-AT-MDL-012524006 | | 137. | GOOG-AT-MDL-018448707 |
| 92. | GOOG-AT-MDL-012549335 | | 138. | GOOG-AT-MDL-018548592 |
| 93. | GOOG-AT-MDL-012693796 | | 139. | GOOG-AT-MDL-018618351 |
| 94. | GOOG-AT-MDL-012767138 | | 140. | GOOG-AT-MDL-018652651 |
| 95. | GOOG-AT-MDL-012837016 | | 141. | GOOG-AT-MDL-018998910 |
| 96. | GOOG-AT-MDL-012857198 | | 142. | GOOG-AT-MDL-019001498 |
| 97. | GOOG-AT-MDL-013290688 | | 143. | GOOG-AT-MDL-019306356 |
| 98. | GOOG-AT-MDL-013291089 | | 144. | GOOG-AT-MDL-019386250 |
| 99. | GOOG-AT-MDL-013292974 | | 145. | GOOG-AT-MDL-019552139 |
| 100. | GOOG-AT-MDL-013299524 | | 146. | GOOG-AT-MDL-019571201 |
| 101. | GOOG-AT-MDL-013299531 | | 147. | GOOG-AT-MDL-019588187 |
| 102. | GOOG-AT-MDL-013300202 | | 148. | GOOG-AT-MDL-019633443 |
| 103. | GOOG-AT-MDL-013378392 | | 149. | GOOG-AT-MDL-019642313 |
| 104. | GOOG-AT-MDL-013908958 | | 150. | GOOG-AT-MDL-019653406 |
| 105. | GOOG-AT-MDL-013918668 | | 151. | GOOG-AT-MDL-019721340 |
| 106. | GOOG-AT-MDL-014427012 | | 152. | GOOG-AT-MDL-019767203 |
| 107. | GOOG-AT-MDL-014460206 | | 153. | GOOG-AT-MDL-B-000134141 |
| 108. | GOOG-AT-MDL-014462378 | | 154. | GOOG-AT-MDL-B-001084151 |
| 109. | GOOG-AT-MDL-014486274 | | 155. | GOOG-AT-MDL-B-001140202 |
| 110. | GOOG-AT-MDL-014524447 | | 156. | GOOG-AT-MDL-B-002087955 |
| 111. | GOOG-AT-MDL-014618288 | | 157. | GOOG-AT-MDL-B-002088697 |
| 112. | GOOG-AT-MDL-015241235 | | 158. | GOOG-AT-MDL-B-002088752 |
| 113. | GOOG-AT-MDL-015622194 | | 159. | GOOG-AT-MDL-B-002088926 |
| 114. | GOOG-AT-MDL-015844174 | | 160. | GOOG-AT-MDL-B-002090567 |
| 115. | GOOG-AT-MDL-015929587 | | 161. | GOOG-AT-MDL-B-002091565 |
| 116. | GOOG-AT-MDL-015997353 | | 162. | GOOG-AT-MDL-B-002095353 |
| 117. | GOOG-AT-MDL-016457027 | | 163. | GOOG-AT-MDL-B-002095501 |
| 118. | GOOG-AT-MDL-016534880 | | 164. | GOOG-AT-MDL-B-002095769 |
| 119. | GOOG-AT-MDL-016627159 | | 165. | GOOG-AT-MDL-B-002097533 |
| 120. | GOOG-AT-MDL-016656237 | | 166. | GOOG-AT-MDL-B-002097570 |
| 121. | GOOG-AT-MDL-016772599 | | 167. | GOOG-AT-MDL-B-002097648 |
| 122. | GOOG-AT-MDL-016838311 | | 168. | GOOG-AT-MDL-B-002098265 |
| 123. | GOOG-AT-MDL-016924839 | | 169. | GOOG-AT-MDL-B-002099366 |
| 124. | GOOG-AT-MDL-016937590 | | 170. | GOOG-AT-MDL-B-002105135 |
| 125. | GOOG-AT-MDL-016943922 | | 171. | GOOG-AT-MDL-B-002500395 |
| 126. | GOOG-AT-MDL-016967094 | | 172. | GOOG-AT-MDL-B-002514153 |

| | |
|---|---|
| 173.  GOOG-AT-MDL-B-002547489 | 219.  GOOG-DOJ-14113270 |
| 174.  GOOG-AT-MDL-B-002552122 | 220.  GOOG-DOJ-14139857 |
| 175.  GOOG-AT-MDL-B-002624643 | 221.  GOOG-DOJ-14155066 |
| 176.  GOOG-AT-MDL-B-002760309 | 222.  GOOG-DOJ-14156827 |
| 177.  GOOG-AT-MDL-B-002762758 | 223.  GOOG-DOJ-14161619 |
| 178.  GOOG-AT-MDL-B-002763194 | 224.  GOOG-DOJ-14161943 |
| 179.  GOOG-AT-MDL-B-002764178 | 225.  GOOG-DOJ-14232497 |
| 180.  GOOG-AT-MDL-B-002764191 | 226.  GOOG-DOJ-14352302 |
| 181.  GOOG-AT-MDL-B-002797051 | 227.  GOOG-DOJ-14352774 |
| 182.  GOOG-AT-MDL-B-002803919 | 228.  GOOG-DOJ-14365517 |
| 183.  GOOG-AT-MDL-B-002837096 | 229.  GOOG-DOJ-14433486 |
| 184.  GOOG-AT-MDL-B-003181628 | 230.  GOOG-DOJ-14433633 |
| 185.  GOOG-AT-MDL-B-003735823 | 231.  GOOG-DOJ-14435110 |
| 186.  GOOG-AT-MDL-B-003741154 | 232.  GOOG-DOJ-14436029 |
| 187.  GOOG-AT-MDL-B-004008753 | 233.  GOOG-DOJ-14453674 |
| 188.  GOOG-AT-MDL-B-004015880 | 234.  GOOG-DOJ-14458088 |
| 189.  GOOG-AT-MDL-B-004016318 | 235.  GOOG-DOJ-14494204 |
| 190.  GOOG-AT-MDL-B-004243337 | 236.  GOOG-DOJ-14544715 |
| 191.  GOOG-AT-MDL-B-004247242 | 237.  GOOG-DOJ-14544743 |
| 192.  GOOG-AT-MDL-B-004265772 | 238.  GOOG-DOJ-14556699 |
| 193.  GOOG-AT-MDL-B-004425247 | 239.  GOOG-DOJ-14712739 |
| 194.  GOOG-AT-MDL-B-004680051 | 240.  GOOG-DOJ-14717683 |
| 195.  GOOG-AT-MDL-B-005083974 | 241.  GOOG-DOJ-14733660 |
| 196.  GOOG-AT-MDL-B-005167304 | 242.  GOOG-DOJ-14735212 |
| 197.  GOOG-AT-MDL-B-005168118 | 243.  GOOG-DOJ-14735427 |
| 198.  GOOG-AT-MDL-B-005170475 | 244.  GOOG-DOJ-14740782 |
| 199.  GOOG-AT-MDL-B-005282318 | 245.  GOOG-DOJ-14743636 |
| 200.  GOOG-AT-MDL-B-005372599 | 246.  GOOG-DOJ-14870370 |
| 201.  GOOG-AT-MDL-B-005457387 | 247.  GOOG-DOJ-15021111 |
| 202.  GOOG-AT-MDL-B-006069467 | 248.  GOOG-DOJ-15022600 |
| 203.  GOOG-AT-MDL-B-006316352 | 249.  GOOG-DOJ-15022611 |
| 204.  GOOG-AT-MDL-B-006365895 | 250.  GOOG-DOJ-15029681 |
| 205.  GOOG-AT-MDL-B-006365981 | 251.  GOOG-DOJ-15041717 |
| 206.  GOOG-AT-MDL-B-006939056 | 252.  GOOG-DOJ-15042589 |
| 207.  GOOG-AT-MDL-B-007212533 | 253.  GOOG-DOJ-15064786 |
| 208.  GOOG-AT-MDL-B-007229334 | 254.  GOOG-DOJ-15071642 |
| 209.  GOOG-AT-MDL-B-007232867 | 255.  GOOG-DOJ-15073261 |
| 210.  GOOG-AT-MDL-B-007353902 | 256.  GOOG-DOJ-15076754 |
| 211.  GOOG-DOJ-12948968 | 257.  GOOG-DOJ-15140608 |
| 212.  GOOG-DOJ-13897780 | 258.  GOOG-DOJ-15173140 |
| 213.  GOOG-DOJ-13899823 | 259.  GOOG-DOJ-15186471 |
| 214.  GOOG-DOJ-13911836 | 260.  GOOG-DOJ-15278949 |
| 215.  GOOG-DOJ-13930748 | 261.  GOOG-DOJ-15371972 |
| 216.  GOOG-DOJ-13940086 | 262.  GOOG-DOJ-15417170 |
| 217.  GOOG-DOJ-14008698 | 263.  GOOG-DOJ-15426837 |
| 218.  GOOG-DOJ-14034714 | 264.  GOOG-DOJ-15427800 |

| 265. | GOOG-DOJ-15428154 | 311. | GOOG-DOJ-32262980 |
|------|-------------------|------|-------------------|
| 266. | GOOG-DOJ-15432090 | 312. | GOOG-DOJ-32265694 |
| 267. | GOOG-DOJ-15433127 | 313. | GOOG-DOJ-AT-00003565 |
| 268. | GOOG-DOJ-15434544 | 314. | GOOG-DOJ-AT-00087809 |
| 269. | GOOG-DOJ-15445478 | 315. | GOOG-DOJ-AT-00252559 |
| 270. | GOOG-DOJ-15526215 | 316. | GOOG-DOJ-AT-00569953 |
| 271. | GOOG-DOJ-15590044 | 317. | GOOG-DOJ-AT-00575435 |
| 272. | GOOG-DOJ-15595543 | 318. | GOOG-DOJ-AT-00588995 |
| 273. | GOOG-DOJ-15597407 | 319. | GOOG-DOJ-AT-00651561 |
| 274. | GOOG-DOJ-15598151 | 320. | GOOG-DOJ-AT-00663174 |
| 275. | GOOG-DOJ-15601229 | 321. | GOOG-DOJ-AT-00750354 |
| 276. | GOOG-DOJ-15616526 | 322. | GOOG-DOJ-AT-01019411 |
| 277. | GOOG-DOJ-15621021 | 323. | GOOG-DOJ-AT-01027937 |
| 278. | GOOG-DOJ-15628088 | 324. | GOOG-DOJ-AT-01514374 |
| 279. | GOOG-DOJ-15631978 | 325. | GOOG-DOJ-AT-01525829 |
| 280. | GOOG-DOJ-15637110 | 326. | GOOG-DOJ-AT-01682499 |
| 281. | GOOG-DOJ-15675958 | 327. | GOOG-DOJ-AT-01811246 |
| 282. | GOOG-DOJ-15733030 | 328. | GOOG-DOJ-AT-01814428 |
| 283. | GOOG-DOJ-15766965 | 329. | GOOG-DOJ-AT-01814688 |
| 284. | GOOG-DOJ-15789579 | 330. | GOOG-DOJ-AT-01815482 |
| 285. | GOOG-DOJ-16271009 | 331. | GOOG-DOJ-AT-01816686 |
| 286. | GOOG-DOJ-16732920 | 332. | GOOG-DOJ-AT-01848255 |
| 287. | GOOG-DOJ-16976651 | 333. | GOOG-DOJ-AT-01933085 |
| 288. | GOOG-DOJ-17101302 | 334. | GOOG-DOJ-AT-02070545 |
| 289. | GOOG-DOJ-17105055 | 335. | GOOG-DOJ-AT-02122748 |
| 290. | GOOG-DOJ-17581278 | 336. | GOOG-DOJ-AT-02146896 |
| 291. | GOOG-DOJ-19090482 | 337. | GOOG-DOJ-AT-02153612 |
| 292. | GOOG-DOJ-19119112 | 338. | GOOG-DOJ-AT-02275074 |
| 293. | GOOG-DOJ-27760500_DUP_1 | 339. | GOOG-DOJ-AT-02275933 |
| 294. | GOOG-DOJ-27762649 | 340. | GOOG-DOJ-AT-02319393 |
| 295. | GOOG-DOJ-27762691 | 341. | GOOG-DOJ-AT-02482767 |
| 296. | GOOG-DOJ-27796586 | 342. | GOOG-DOJ-AT-02634336 |
| 297. | GOOG-DOJ-27803156 | 343. | GOOG-DOJ-AT-02639830 |
| 298. | GOOG-DOJ-27803505 | 344. | GOOG-NE-01787563 |
| 299. | GOOG-DOJ-27803533 | 345. | GOOG-NE-02557667 |
| 300. | GOOG-DOJ-27804205 | 346. | GOOG-NE-02558055 |
| 301. | GOOG-DOJ-27804876 | 347. | GOOG-NE-03231727 |
| 302. | GOOG-DOJ-28385887 | 348. | GOOG-NE-03236272 |
| 303. | GOOG-DOJ-28420330 | 349. | GOOG-NE-03467508 |
| 304. | GOOG-DOJ-29427368 | 350. | GOOG-NE-03616222 |
| 305. | GOOG-DOJ-29453844 | 351. | GOOG-NE-03627597 |
| 306. | GOOG-DOJ-30066802 | 352. | GOOG-NE-03727939 |
| 307. | GOOG-DOJ-32018179 | 353. | GOOG-NE-03844060 |
| 308. | GOOG-DOJ-32018452 | 354. | GOOG-NE-03869994 |
| 309. | GOOG-DOJ-32022422 | 355. | GOOG-NE-03872605 |
| 310. | GOOG-DOJ-32062262 | 356. | GOOG-NE-04304005 |

15

| | |
|---|---|
| 357. GOOG-NE-04689402 | 403. GOOG-NE-13386334 |
| 358. GOOG-NE-05241137 | 404. GOOG-NE-13389481 |
| 359. GOOG-NE-05270679 | 405. GOOG-NE-13390045 |
| 360. GOOG-NE-06113062 | 406. GOOG-NE-13393115 |
| 361. GOOG-NE-06547825 | 407. GOOG-NE-13401911 |
| 362. GOOG-NE-06568562 | 408. GOOG-NE-13405025 |
| 363. GOOG-NE-06568719 | 409. GOOG-NE-13415537 |
| 364. GOOG-NE-06729717 | 410. GOOG-NE-13541543 |
| 365. GOOG-NE-06841582 | 411. GOOG-NE-13569193 |
| 366. GOOG-NE-07841238 | 412. GOOG-NE-13577462 |
| 367. GOOG-NE-07946731 | 413. GOOG-NE-13589899 |
| 368. GOOG-NE-08116078 | 414. GOOG-NE-13624783 |
| 369. GOOG-NE-08112779 | 415. GOOG-TEX-00039266 |
| 370. GOOG-NE-09138394 | 416. GOOG-TEX-00079344 |
| 371. GOOG-NE-09698556 | 417. GOOG-TEX-00089835 |
| 372. GOOG-NE-09711564 | 418. GOOG-TEX-00090151 |
| 373. GOOG-NE-10573952 | 419. GOOG-TEX-00090282 |
| 374. GOOG-NE-10660658 | 420. GOOG-TEX-00090969 |
| 375. GOOG-NE-10660882 | 421. GOOG-TEX-00092657 |
| 376. GOOG-NE-10777158 | 422. GOOG-TEX-00105202 |
| 377. GOOG-NE-10952313 | 423. GOOG-TEX-00105361 |
| 378. GOOG-NE-10976657 | 424. GOOG-TEX-00106255 |
| 379. GOOG-NE-10977717 | 425. GOOG-TEX-00109167 |
| 380. GOOG-NE-10978402 | 426. GOOG-TEX-00110068 |
| 381. GOOG-NE-10985565 | 427. GOOG-TEX-00110540 |
| 382. GOOG-NE-11813912 | 428. GOOG-TEX-00110544 |
| 383. GOOG-NE-11847370 | 429. GOOG-TEX-00111494 |
| 384. GOOG-NE-11877282 | 430. GOOG-TEX-00116069 |
| 385. GOOG-NE-12727978 | 431. GOOG-TEX-00116639 |
| 386. GOOG-NE-12738745 | 432. GOOG-TEX-00119737 |
| 387. GOOG-NE-12742008 | 433. GOOG-TEX-00119845 |
| 388. GOOG-NE-12787759 | 434. GOOG-TEX-00120626 |
| 389. GOOG-NE-12885078 | 435. GOOG-TEX-00120775 |
| 390. GOOG-NE-13004102 | 436. GOOG-TEX-00156142 |
| 391. GOOG-NE-13200100 | 437. GOOG-TEX-00167119 |
| 392. GOOG-NE-13205235 | 438. GOOG-TEX-00177559 |
| 393. GOOG-NE-13205865 | 439. GOOG-TEX-00206687 |
| 394. GOOG-NE-13210272 | 440. GOOG-TEX-00216163 |
| 395. GOOG-NE-13327192 | 441. GOOG-TEX-00234150 |
| 396. GOOG-NE-13340752 | 442. GOOG-TEX-00240572 |
| 397. GOOG-NE-13349343 | 443. GOOG-TEX-00270127 |
| 398. GOOG-NE-13367768 | 444. GOOG-TEX-00271177 |
| 399. GOOG-NE-13369624 | 445. GOOG-TEX-00309326 |
| 400. GOOG-NE-13373170 | 446. GOOG-TEX-00326649 |
| 401. GOOG-NE-13374150 | 447. GOOG-TEX-00336527 |
| 402. GOOG-NE-13379438 | 448. GOOG-TEX-00344083 |

| | | | | |
|---|---|---|---|---|
| 449. | GOOG-TEX-00370306 | | 495. | FBTEX_00327637 |
| 450. | GOOG-TEX-00374779 | | 496. | FBTEX_00327693 |
| 451. | GOOG-TEX-00375239 | | 497. | FBTEX_00392049 |
| 452. | GOOG-TEX-00452866 | | 498. | FBTEX_00499187 |
| 453. | GOOG-TEX-00513684 | | 499. | FBTEX_00585545 |
| 454. | GOOG-TEX-00643890 | | 500. | FBTEX_00785569 |
| 455. | GOOG-TEX-00689539 | | 501. | FBTEX_00797432 |
| 456. | GOOG-TEX-00705131 | | 502. | FBTEX_00808290 |
| 457. | GOOG-TEX-00715805 | | 503. | FBTEX_00953261 |
| 458. | GOOG-TEX-00716782 | | 504. | FBTEX_00953264 |
| 459. | GOOG-TEX-00777573 | | 505. | FBTEX_01101140 |
| 460. | GOOG-TEX-00778301 | | 506. | FBTEX_01102588 |
| 461. | GOOG-TEX-00797340 | | 507. | FBTEX_01102592 |
| 462. | GOOG-TEX-00806640 | | 508. | FBTEX_01153364 |
| 463. | GOOG-TEX-00806682 | | 509. | FBTEX_01246808 |
| 464. | GOOG-TEX-00814407 | | 510. | FBTX_00528334 |
| 465. | GOOG-TEX-00825713 | | 511. | GOOG-AT-MDL-000991808 |
| 466. | GOOG-TEX-00828547 | | 512. | GOOG-AT-MDL-001386659 |
| 467. | GOOG-TEX-00831660 | | 513. | GOOG-AT-MDL-001396947 |
| 468. | GOOG-TEX-00850729 | | 514. | GOOG-AT-MDL-001398467 |
| 469. | GOOG-TEX-00858576 | | 515. | GOOG-AT-MDL-001403170 |
| 470. | GOOG-TEX-00905673 | | 516. | GOOG-AT-MDL-001412455 |
| 471. | GOOG-TEX-00959457 | | 517. | GOOG-AT-MDL-001428366 |
| 472. | GOOG-TEX-00959461 | | 518. | GOOG-AT-MDL-001439138 |
| 473. | GOOG-TEX-00969525 | | 519. | GOOG-AT-MDL-001446832 |
| 474. | GOOG-TEX-00978814 | | 520. | GOOG-AT-MDL-001828386 |
| 475. | GOOG-TEX-01004466 | | 521. | GOOG-AT-MDL-001972093 |
| 476. | GOOG-TEX-01036150 | | 522. | GOOG-AT-MDL-002468282 |
| 477. | GOOG-TEX-01142635 | | 523. | GOOG-AT-MDL-002468549 |
| 478. | GOOG-TEX-01244428 | | 524. | GOOG-AT-MDL-003408566 |
| 479. | GOOG-TEX-01279945 | | 525. | GOOG-AT-MDL-003518690 |
| 480. | GOOG-TEX-00974499 | | 526. | GOOG-AT-MDL-003530493 |
| 481. | GOOG-TEX-00001418 | | 527. | GOOG-AT-MDL-003596410 |
| 482. | GOOG-TEX-00597317 | | 528. | GOOG-AT-MDL-003664784 |
| 483. | METATX_000000680 | | 529. | GOOG-AT-MDL-003675001 |
| 484. | NEXSTAR090311 | | 530. | GOOG-AT-MDL-003752136 |
| 485. | FBDOJ012641326 | | 531. | GOOG-AT-MDL-003832428 |
| 486. | FBDOJ012850073 | | 532. | GOOG-AT-MDL-003960772 |
| 487. | FBDOJ012851003 | | 533. | GOOG-AT-MDL-003960884 |
| 488. | FBDOJ012977432 | | 534. | GOOG-AT-MDL-003984934 |
| 489. | FBDOJ013020154 | | 535. | GOOG-AT-MDL-004284828 |
| 490. | FBDOJ013047835 | | 536. | GOOG-AT-MDL-004285638 |
| 491. | FBDOJGOOG_01258632 | | 537. | GOOG-AT-MDL-004324549 |
| 492. | FBDOJGOOG_01480889 | | 538. | GOOG-AT-MDL-004416737 |
| 493. | FBTEX_00116640 | | 539. | GOOG-AT-MDL-004555192 |
| 494. | FBTEX_0032675692 | | 540. | GOOG-AT-MDL-004555207 |

541.  GOOG-AT-MDL-006174827
542.  GOOG-AT-MDL-006188292
543.  GOOG-AT-MDL-006219137
544.  GOOG-AT-MDL-006609824
545.  GOOG-AT-MDL-006967178
546.  GOOG-AT-MDL-007035393
547.  GOOG-AT-MDL-007184067
548.  GOOG-AT-MDL-007297431
549.  GOOG-AT-MDL-007306174
550.  GOOG-AT-MDL-007344294
551.  GOOG-AT-MDL-007397194
552.  GOOG-AT-MDL-007412020
553.  GOOG-AT-MDL-008120608
554.  GOOG-AT-MDL-008148529
555.  GOOG-AT-MDL-008148533
556.  GOOG-AT-MDL-008401232
557.  GOOG-AT-MDL-008515131
558.  GOOG-AT-MDL-008682071
559.  GOOG-AT-MDL-008770862
560.  GOOG-AT-MDL-008842383
561.  GOOG-AT-MDL-008947559
562.  GOOG-AT-MDL-008950810
563.  GOOG-AT-MDL-008953875
564.  GOOG-AT-MDL-008956205
565.  GOOG-AT-MDL-008959102
566.  GOOG-AT-MDL-008963668
567.  GOOG-AT-MDL-008964584
568.  GOOG-AT-MDL-008967988
569.  GOOG-AT-MDL-008973378
570.  GOOG-AT-MDL-008979450
571.  GOOG-AT-MDL-008984168
572.  GOOG-AT-MDL-008986552
573.  GOOG-AT-MDL-008986864
574.  GOOG-AT-MDL-008991190
575.  GOOG-AT-MDL-008992510
576.  GOOG-AT-MDL-009025979
577.  GOOG-AT-MDL-009036094
578.  GOOG-AT-MDL-009367449
579.  GOOG-AT-MDL-009709715
580.  GOOG-AT-MDL-012331946
581.  GOOG-AT-MDL-012512067
582.  GOOG-AT-MDL-012709388
583.  GOOG-AT-MDL-012766862
584.  GOOG-AT-MDL-012771724
585.  GOOG-AT-MDL-012781882
586.  GOOG-AT-MDL-013107815

587.  GOOG-AT-MDL-013134435
588.  GOOG-AT-MDL-013274837
589.  GOOG-AT-MDL-013284385
590.  GOOG-AT-MDL-013304990
591.  GOOG-AT-MDL-013305020
592.  GOOG-AT-MDL-014005744
593.  GOOG-AT-MDL-014157435
594.  GOOG-AT-MDL-014188789
595.  GOOG-AT-MDL-014305171
596.  GOOG-AT-MDL-014566000
597.  GOOG-AT-MDL-014566081
598.  GOOG-AT-MDL-014570102
599.  GOOG-AT-MDL-014825556
600.  GOOG-AT-MDL-015177997
601.  GOOG-AT-MDL-015214562
602.  GOOG-AT-MDL-015262116
603.  GOOG-AT-MDL-015718221
604.  GOOG-AT-MDL-015753088
605.  GOOG-AT-MDL-015924793
606.  GOOG-AT-MDL-015995550
607.  GOOG-AT-MDL-017320175
608.  GOOG-AT-MDL-017663254
609.  GOOG-AT-MDL-017781794
610.  GOOG-AT-MDL-018243919
611.  GOOG-AT-MDL-018467177
612.  GOOG-AT-MDL-018513313
613.  GOOG-AT-MDL-018631724
614.  GOOG-AT-MDL-018673806
615.  GOOG-AT-MDL-018796926
616.  GOOG-AT-MDL-019006242
617.  GOOG-AT-MDL-019010409
618.  GOOG-AT-MDL-019045181
619.  GOOG-AT-MDL-019164293
620.  GOOG-AT-MDL-019198499
621.  GOOG-AT-MDL-019244499
622.  GOOG-AT-MDL-019521362
623.  GOOG-AT-MDL-019585702
624.  GOOG-AT-MDL-019608993
625.  GOOG-AT-MDL-019724612
626.  GOOG-AT-MDL-B-000744067
627.  GOOG-AT-MDL-B-000762975
628.  GOOG-AT-MDL-B-001128860
629.  GOOG-AT-MDL-B-001605461
630.  GOOG-AT-MDL-B-001605538
631.  GOOG-AT-MDL-B-001633930
632.  GOOG-AT-MDL-B-001831512

633.  GOOG-AT-MDL-B-001833845
634.  GOOG-AT-MDL-B-001838986
635.  GOOG-AT-MDL-B-001856427
636.  GOOG-AT-MDL-B-001876817
637.  GOOG-AT-MDL-B-002085667
638.  GOOG-AT-MDL-B-002090556
639.  GOOG-AT-MDL-B-002096327
640.  GOOG-AT-MDL-B-002110895
641.  GOOG-AT-MDL-B-002235587
642.  GOOG-AT-MDL-B-002504803
643.  GOOG-AT-MDL-B-002505352
644.  GOOG-AT-MDL-B-002508987
645.  GOOG-AT-MDL-B-002535093
646.  GOOG-AT-MDL-B-002762725
647.  GOOG-AT-MDL-B-002763539
648.  GOOG-AT-MDL-B-003179191
649.  GOOG-AT-MDL-B-003289748
650.  GOOG-AT-MDL-B-003741171
651.  GOOG-AT-MDL-B-003754823
652.  GOOG-AT-MDL-B-004016354
653.  GOOG-AT-MDL-B-004246657
654.  GOOG-AT-MDL-B-004246668
655.  GOOG-AT-MDL-B-004637454
656.  GOOG-AT-MDL-B-004864657
657.  GOOG-AT-MDL-B-006307109
658.  GOOG-AT-MDL-B-006365520
659.  GOOG-AT-MDL-B-007244076
660.  GOOG-AT-MDL-C-000010785
661.  GOOG-DOJ-00300834
662.  GOOG-DOJ-13912541
663.  GOOG-DOJ-13918991
664.  GOOG-DOJ-13931782
665.  GOOG-DOJ-13935674
666.  GOOG-DOJ-13942082
667.  GOOG-DOJ-13949363
668.  GOOG-DOJ-13952417
669.  GOOG-DOJ-13984617
670.  GOOG-DOJ-13990174
671.  GOOG-DOJ-13991370
672.  GOOG-DOJ-13997420
673.  GOOG-DOJ-14039876
674.  GOOG-DOJ-14141075
675.  GOOG-DOJ-14155094
676.  GOOG-DOJ-14156098
677.  GOOG-DOJ-14156657
678.  GOOG-DOJ-14160868
679.  GOOG-DOJ-14231410
680.  GOOG-DOJ-14248141
681.  GOOG-DOJ-14254613
682.  GOOG-DOJ-14265301
683.  GOOG-DOJ-14368344
684.  GOOG-DOJ-14380896
685.  GOOG-DOJ-14398632
686.  GOOG-DOJ-14433810
687.  GOOG-DOJ-14433907
688.  GOOG-DOJ-14435887
689.  GOOG-DOJ-14441373
690.  GOOG-DOJ-14469279
691.  GOOG-DOJ-14473642
692.  GOOG-DOJ-14495239
693.  GOOG-DOJ-14510835
694.  GOOG-DOJ-14510945
695.  GOOG-DOJ-14526230
696.  GOOG-DOJ-14550176
697.  GOOG-DOJ-14551574
698.  GOOG-DOJ-14559099
699.  GOOG-DOJ-14705058
700.  GOOG-DOJ-14706688
701.  GOOG-DOJ-14707242
702.  GOOG-DOJ-14709267
703.  GOOG-DOJ-14712029
704.  GOOG-DOJ-14718827
705.  GOOG-DOJ-14733010
706.  GOOG-DOJ-14733299
707.  GOOG-DOJ-14735629
708.  GOOG-DOJ-14736531
709.  GOOG-DOJ-14743554
710.  GOOG-DOJ-14744814
711.  GOOG-DOJ-14832749
712.  GOOG-DOJ-14879034
713.  GOOG-DOJ-14954902
714.  GOOG-DOJ-15046502
715.  GOOG-DOJ-15064096
716.  GOOG-DOJ-15064794
717.  GOOG-DOJ-15065751
718.  GOOG-DOJ-15071643
719.  GOOG-DOJ-15078089
720.  GOOG-DOJ-15084805
721.  GOOG-DOJ-15085650
722.  GOOG-DOJ-15129170
723.  GOOG-DOJ-15164364
724.  GOOG-DOJ-15359510

| | | | | |
|---|---|---|---|---|
| 725. | GOOG-DOJ-15370825 | | 771. | GOOG-DOJ-AT-01423537 |
| 726. | GOOG-DOJ-15421777 | | 772. | GOOG-DOJ-AT-01481161 |
| 727. | GOOG-DOJ-15421837 | | 773. | GOOG-DOJ-AT-01490095 |
| 728. | GOOG-DOJ-15426012 | | 774. | GOOG-DOJ-AT-01517573 |
| 729. | GOOG-DOJ-15428402 | | 775. | GOOG-DOJ-AT-01526572 |
| 730. | GOOG-DOJ-15433150 | | 776. | GOOG-DOJ-AT-01564508 |
| 731. | GOOG-DOJ-15435125 | | 777. | GOOG-DOJ-AT-01620514 |
| 732. | GOOG-DOJ-15445619 | | 778. | GOOG-DOJ-AT-01682498 |
| 733. | GOOG-DOJ-15446667 | | 779. | GOOG-DOJ-AT-01800023 |
| 734. | GOOG-DOJ-15472771 | | 780. | GOOG-DOJ-AT-01808791 |
| 735. | GOOG-DOJ-15476271 | | 781. | GOOG-DOJ-AT-01809117 |
| 736. | GOOG-DOJ-15603884 | | 782. | GOOG-DOJ-AT-01811118 |
| 737. | GOOG-DOJ-15612215 | | 783. | GOOG-DOJ-AT-01812188 |
| 738. | GOOG-DOJ-15720586 | | 784. | GOOG-DOJ-AT-01827124 |
| 739. | GOOG-DOJ-15769196 | | 785. | GOOG-DOJ-AT-01831448 |
| 740. | GOOG-DOJ-15772422 | | 786. | GOOG-DOJ-AT-01849832 |
| 741. | GOOG-DOJ-15820805 | | 787. | GOOG-DOJ-AT-01892558 |
| 742. | GOOG-DOJ-27571503 | | 788. | GOOG-DOJ-AT-01902474 |
| 743. | GOOG-DOJ-27759823 | | 789. | GOOG-DOJ-AT-01908449 |
| 744. | GOOG-DOJ-27760500 | | 790. | GOOG-DOJ-AT-02137259 |
| 745. | GOOG-DOJ-27762880 | | 791. | GOOG-DOJ-AT-02137346 |
| 746. | GOOG-DOJ-28417257 | | 792. | GOOG-DOJ-AT-02147591 |
| 747. | GOOG-DOJ-28486313 | | 793. | GOOG-DOJ-AT-02149824 |
| 748. | GOOG-DOJ-28501678 | | 794. | GOOG-DOJ-AT-02151279 |
| 749. | GOOG-DOJ-29625035 | | 795. | GOOG-DOJ-AT-02151860 |
| 750. | GOOG-DOJ-29731245 | | 796. | GOOG-DOJ-AT-02156432 |
| 751. | GOOG-DOJ-29803801 | | 797. | GOOG-DOJ-AT-02156890 |
| 752. | GOOG-DOJ-32277291 | | 798. | GOOG-DOJ-AT-02172942 |
| 753. | GOOG-DOJ-32283742 | | 799. | GOOG-DOJ-AT-02190909 |
| 754. | GOOG-DOJ-32311857 | | 800. | GOOG-DOJ-AT-02193235 |
| 755. | GOOG-DOJ-32321240 | | 801. | GOOG-DOJ-AT-02195580 |
| 756. | GOOG-DOJ-32629220 | | 802. | GOOG-DOJ-AT-02195610 |
| 757. | GOOG-DOJ-AT-00337555 | | 803. | GOOG-DOJ-AT-02195675 |
| 758. | GOOG-DOJ-AT-00349951 | | 804. | GOOG-DOJ-AT-02197386 |
| 759. | GOOG-DOJ-AT-00596359 | | 805. | GOOG-DOJ-AT-02199374 |
| 760. | GOOG-DOJ-AT-00597161 | | 806. | GOOG-DOJ-AT-02218994 |
| 761. | GOOG-DOJ-AT-00598647 | | 807. | GOOG-DOJ-AT-02224601 |
| 762. | GOOG-DOJ-AT-00634965 | | 808. | GOOG-DOJ-AT-02225684 |
| 763. | GOOG-DOJ-AT-00916063 | | 809. | GOOG-DOJ-AT-02261785 |
| 764. | GOOG-DOJ-AT-01016519 | | 810. | GOOG-DOJ-AT-02274670 |
| 765. | GOOG-DOJ-AT-01019307 | | 811. | GOOG-DOJ-AT-02323144 |
| 766. | GOOG-DOJ-AT-01140595 | | 812. | GOOG-DOJ-AT-02366287 |
| 767. | GOOG-DOJ-AT-01251555 | | 813. | GOOG-DOJ-AT-02424328 |
| 768. | GOOG-DOJ-AT-01255154 | | 814. | GOOG-DOJ-AT-02467209 |
| 769. | GOOG-DOJ-AT-01288913 | | 815. | GOOG-DOJ-AT-02499720 |
| 770. | GOOG-DOJ-AT-01423320 | | 816. | GOOG-DOJ-AT-02640072 |

817.  GOOG-NE-02632899
818.  GOOG-NE-03597611
819.  GOOG-NE-03616755
820.  GOOG-NE-03634720
821.  GOOG-NE-04384116
822.  GOOG-NE-04719370
823.  GOOG-NE-05284000
824.  GOOG-NE-06580783
825.  GOOG-NE-06835928
826.  GOOG-NE-07245622
827.  GOOG-NE-07249243
828.  GOOG-NE-07294175
829.  GOOG-NE-09426318
830.  GOOG-NE-10291781
831.  GOOG-NE-10493534
832.  GOOG-NE-11375580
833.  GOOG-NE-11849783
834.  GOOG-NE-11917922
835.  GOOG-NE-12720608
836.  GOOG-NE-13197548
837.  GOOG-NE-13199159
838.  GOOG-NE-13202480
839.  GOOG-NE-13203514
840.  GOOG-NE-13209197
841.  GOOG-NE-13210980
842.  GOOG-NE-13212314
843.  GOOG-NE-13217070
844.  GOOG-NE-13226622
845.  GOOG-NE-13231717
846.  GOOG-NE-13231861
847.  GOOG-NE-13232022
848.  GOOG-NE-13351825
849.  GOOG-NE-13357217
850.  GOOG-NE-13388834
851.  GOOG-NE-13394781
852.  GOOG-NE-13468541
853.  GOOG-NE-13489067
854.  GOOG-NE-13499149
855.  GOOG-NE-13501797
856.  GOOG-NE-13504124
857.  GOOG-NE-13505379
858.  GOOG-NE-13512082
859.  GOOG-NE-13513997
860.  GOOG-NE-13603380
861.  GOOG-NE-13604113
862.  GOOG-NE-13604518

863.  GOOG-TEX-00041478
864.  GOOG-TEX-00059386
865.  GOOG-TEX-00079917
866.  GOOG-TEX-00090958
867.  GOOG-TEX-00093402
868.  GOOG-TEX-00103040
869.  GOOG-TEX-00104475
870.  GOOG-TEX-00118526
871.  GOOG-TEX-00134993
872.  GOOG-TEX-00263099
873.  GOOG-TEX-00264386
874.  GOOG-TEX-00304200
875.  GOOG-TEX-00329374
876.  GOOG-TEX-00363227
877.  GOOG-TEX-00595685
878.  GOOG-TEX-00596761
879.  GOOG-TEX-00683280
880.  GOOG-TEX-00703289
881.  GOOG-TEX-00725911
882.  GOOG-TEX-00777573
883.  GOOG-TEX-00831090
884.  GOOG-TEX-00969363
885.  GOOG-TEX-00969653
886.  GOOG-TEX-01008914
887.  GOOG-TEX-01009154
888.  GOOG-TEX-01022605
889.  GOOG-TEX-01068770
890.  GOOG-TEX-01084554
891.  GOOG-TEX-01086106
892.  GOOG-TEX-01231847
893.  GOOG-TX-00001418
894.  GOOG-TX-00093439
895.  GOOG-TX-00597317
896.  METATX_000000295
897.  NEWSCORP-TXCID-00000269
898.  NEWSCORP-TXCID-000022
899.  OKELLY000423